SCIENTIFIC AMERICAN

THE AEROSCOPE AT THE PANAMA-PACIFIC EXPOSITION.—[See page 344.]

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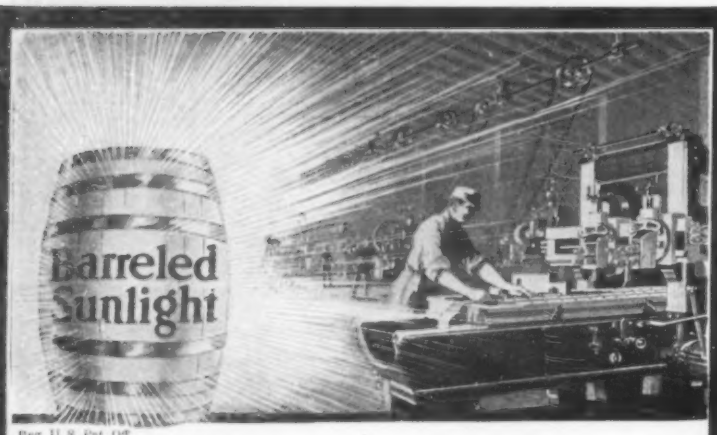

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Sold direct from our factory in barrels containing sufficient paint to cover 20,000 square feet—one coat.

Write for booklet, "More Light," and Sample Board.

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On inside concrete Rice's Granolith makes the best possible primer for a second coat of Rice's Gloss Mill-White—giving a tile-like enamel finish at no more expense than lead and oil paint.
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We are staking fortunes on this offer, but not rashly. We have already worn out 5000 S-V's in recorded tests and comparisons. Barring accidents, we know that Goodyear S-V's will win out in that test.

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This S-V is the final result of eight years spent on Truck Tires. We have had scores of experts at work on them. We have had a department of Research and Experiment which costs $100,000 per year.

We built 29 types before this one. We built 74 models of this S-V before we reached the limit. Now we have what seems to be the utmost in a Truck Tire.

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These are pressed-on tires, without a single auxiliary fastening. That saves much cost, much weight. The minimum pressure is 50,000 pounds, so that creeping is impossible.

The shape ends bulging, breaking or excessive grind. The compound minimizes friction-tax, both on tire and power.

The tread, the backing and the rim are, by a secret process, made inseparable in use.

And the tread offers 20 per cent. extra wear in available rubber.

Consult our local branch—or us—as to where to get S-V Truck Tires under this amazing warrant.

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SEVENTY-FIRST YEAR

SCIENTIFIC AMERICAN

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Experiments to discover the effect of radio-active ores on plant life.

Radio-Active Ores and Plant Life

By Harold Bastin

A SERIES of experiments, designed to show the effects of radio-active materials on plant life, has been conducted by Mr. Martin H. F. Sutton, a member of a well-known firm of English seedsmen. Mr. Sutton's interest in the question was stimulated by the following story. A certain artisan had a heap of soil on his premises and, finding it an obstruction, distributed it over a small patch of garden land, the soil of which had previously been remarkably poor and unproductive. It so happened that the material composing the heap had originally come from one of the "dumps," or refuse mounds, at the French Radium Mine, near Truro, in Cornwall, England. Its application to the garden land led, so it is alleged, to a remarkable improvement in the crops which were grown there during the following summer.

With the object of securing definite information bearing upon this subject, and in the interest of scientific research, Mr. Sutton procured several hundredweight of ore containing radium, as well as certain residues, and with this material carried out an elaborate series of trials with peas, radishes, lettuces, tomatoes, nasturtiums, rapes, clovers, and various flowering annuals, the whole series of experiments comprising some six hundred pots and boxes. In the case of each subject, the dates of sowing, planting and watering, as well as the number of plants treated, were identical; while, except in the case of the rapes and clovers, the trials were conducted in the open without special precautions. The proportion of ore or residue mixed with the soil varied from 1 part in 12 to 1 part in 2,240; and in every experiment the ore or residue was in one box or pot well mixed with the soil, and in another box placed in a layer beneath the soil. The results of every experiment were also compared with "control" batches of plants grown in plain soil only, also with other batches grown in soils with which manures and fertilizers of various kinds had been mixed.

The results of these experiments have been far less uniform than one might have felt inclined to predict, that is to say, some kinds of plants appear to benefit greatly from the presence of radium or allied substances in the soil, while other kinds are scarcely affected. In the case of lettuces, for example, the tabulated results show that seven out of the ten boxes containing radio-active material gave heavier results than the "control" box, but none was so heavy as the product of the box dressed with a complete fertilizer. This, as Mr. Sutton remarks, seems to show that the radio-active ores increased the weight of the lettuces, though not so effectively as the fertilizer referred to. On the other hand, the response of radishes to radio-treatment was very marked. All the boxes containing radio-active materials gave greater weights than the "control" box, while six of them were heavier than those dressed with manures and fertilizers. Scarcely any difference can be seen in peas grown under radio-active conditions, while the same remark applies to carnations.

The experiments conducted with rape and red clover were designed to show the effect of radio-active substances on germination. The boxes of rape received no artificial heat, but those containing the clovers were placed in a greenhouse of moderate temperature. In all other respects the conditions were identical. The results were extremely interesting. The seeds were sown on July 20th. With one exception, which was a trifle later than the others, all the rape seed sown in soil dressed with ore or residue germinated first and equally. On July 27th the "residue" boxes held first place, being followed by "ore," "control," "Clay's fertilizer," "farm yard manure," and "guano" in the order given. In the case of red clover, sown on the same date, all the lots germinated evenly and together, with the exception of "Clay's fertilizer" and "guano," which were a little delayed. As with the rape, however, all the lots of red clover dressed with "residue" were distinctly strongest on July 27th, the positions occupied by the other lots being also approximately the same, with "guano" last.

So far as these experiments have been carried, they seem to show that whereas radio-active materials benefit, in greater or less degree, rapes, clovers, radishes, and lettuces, they have little or no effect upon peas, tomatoes, nasturtiums and other flowering annuals. Soil treated with black oxide of uranium in the proportion of 1 part in 2,240 appeared generally to make the plants more sturdy; but in these cases it was noticeable that the inflorescence was retarded.

Belgian Bridge in Reinforced Concrete

THE bridge upon the Meuse River in Belgium, at Bouvignes, is a recent example of reinforced concrete work. Lying as it does in the region of the war, it is not unreasonable to suppose that, like other bridges in Belgium, it was exposed to more or less damage. The present bridge has a total length between abutments of 393 feet, being made up of a mid-river span 110 feet long and two end spans, each of about 140 feet. Reinforced concrete on the French Hennebique system is used here. Outside width of the bridge is 13 feet, including wagon way and two footways, and the former is paved with compressed asphalt laid directly on the reinforced concrete bridge-planking. This makes the roadway very elastic and is found to be an excellent method. Some points about the building of the two piers in the river may be of interest. This work was carried out by means of caissons built of reinforced concrete and further stiffened by webs of the same. After the cement had set, the caisson was sunk upon the prepared rock surface. Two layers of cement sacks had been put in place upon the rock by a squad of divers so as to form a good level base for receiving the caisson. After lowering upon this prepared surface, a diver went down to inspect the inside and see that all was in place, after which concrete was run into the caisson so as to fill up to about 8 feet on the bottom. When this layer had set, the caisson was pumped out by turbine pump on the scaffolding, and when empty the filling of the caisson was then carried on by 8-inch layers of concrete, each layer being well pounded in place, thus reaching the top of the caisson. Height above the foundation is about 20 feet, and the top projects 3 feet out of the water. The foundations for abutments are of interest as having been laid by the use of the "compressol" concrete well system, using a pointed ram of the pile-driver kind to sink a deep hole and compress the soil around it, the well then being filled with rock pounded in, and then with rock and cement layers. This gave a solid foundation for the abutments, these being of reinforced concrete, and the iron work is consolidated with the concrete of the ground wells so as to make a monolith construction. The North Belgian Railroad runs along one bank of the river.

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Munn & Co., Inc., 233 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp* the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Submarine Disaster

THE shocking disaster, at Honolulu, to "F-4," one of our later destroyers, involving the loss of the boat and the whole of its crew, has brought home to the people of the United States a realization of the ever-present perils which attend the operation of submarines.

In the earlier years of the development of this type of craft, accidents of the kind which has now happened to "F-4" were alarmingly frequent. During the past decade death has taken heavy toll of the men who go down into the sea on underwater craft, and particularly among those nations, France, Great Britain, and Germany, which have been active in the construction and trying out of the submarine.

Bearing this in mind, and remembering that we have at the present time built and under construction in the United States Navy over half a hundred submarines, and that our officers and crew have been engaged in handling these vessels for the past fifteen years, there is a mournful satisfaction in knowing that the disaster to "F-4" is the first fatal accident that has occurred in our submarine service. There have been accidents, of course. More than once our boats have sunk to the bottom and remained there much longer than their commanders intended, causing thereby no little anxiety. But in every case the seat of the trouble was located and the boat brought safely back to the surface.

The cause of the loss of "F-4" remains at the present writing a mystery. Doubtless, by the time this issue appears the wreck will have been brought ashore and the cause of the disaster ascertained. It would be a misfortune if the loss of this boat shook the confidence of the public in this new form of naval warfare. In the service it is understood that foundering is only one among several forms of accident to which the submarine is liable, and the fact that something went wrong on this boat will not serve to shake the confidence of men or officers. Indeed, it only takes a few minutes' conversation with them to realize that, in the service, the submarine is regarded with growing appreciation. No professional man ventures to set a limit to its potentialities when it shall have achieved its maximum development in size, speed, seagoing qualities, and extended radius of action.

The great length of time required to bring "F-4" to the surface after it had been located suggests that, since we have a submarine fleet of such considerable proportions, the Navy should build at least two of those powerful, floating, submarine-salvage ships with which the foreign navies are equipped. More than once we have given illustrated descriptions of these vessels, and we understand that they have done very efficient work in emergencies. The United States Navy ought to have one of these craft in the Pacific and another in the Atlantic, centrally located with regard to our submarine bases.

Although the submarine, because of the success of the Germans in sinking some of the slower warships and many of the slower merchant vessels of the enemy, has given the public an exaggerated estimate of its present military value, no such impression has been made upon the officers and men of our own service. The submarine, it is admitted, has done excellent work within the limits of its capacity; but it is realized that its speed and cruising radius, especially in the submerged condition, must be greatly increased before it can exercise a controlling influence upon naval operations as a whole.

Battleships With Battle-cruiser Speed

THE principal objection on the part of our Navy Department to the construction of battle-cruisers is that their side armor is too light to enable them to stand in the line with battleships, with any hope of keeping out the heavy armor-piercing shells of the enemy's battleships. The great strategical and tactical value of high speed is admitted; but the sacrifice of armor involved has been looked upon as an insuperable objection, at least until our battleship line has been brought up to the standard of strength called for by the General Board of the Navy.

That objection, however, has been met in those five remarkable ships known as the "Queen Elizabeth" class. Here we have dreadnoughts carrying the heaviest guns afloat, protected by 13 or 14 inches of armor on the water-line and turrets, and nevertheless able to steam at 26 knots or over in service. Twenty-five knots was the speed called for, but, as usual, the Parsons turbines have pulled an extra knot or two out of these ships, and the whole of the group will be capable of doing from 26 to 27 knots when called upon. The succeeding ships of the "Royal Sovereign" class, it is true, have dropped back to the 21-knot standard speed for dreadnought battleships. Evidently it was the design of the British Admiralty to provide the commander-in-chief of the fleet with a division whose combination of power, protection, and speed would render it of the highest strategical and tactical value in the operations of a great war. It can accept or refuse battle at will, and, by virtue of its speed, it can attack the rearmost ships of a fleeing enemy and delay him, until the main fleet can come up and engage.

Forts vs. Battleships

THERE seems to be little doubt that something has gone wrong with the attack of the Allies upon the forts which line both sides of the Straits of the Dardanelles. Since the grand attack in force, when three battleships were sunk and several severely punished, there has been a perceptible lull in the operations. We hear less talk about forcing the Dardanelles and crushing the fortifications by overwhelming gun-fire, and more about the necessity for capturing the positions from the land side.

Of course, the situation of the straits is a peculiarly difficult one for an attacking force, especially if the endeavor to force the straits is made from the westward. This is due to the fact that a very swift current sets from the Sea of Marmora to the Mediterranean, and that this renders it possible for the Turks to transfer the floating mine into a mobile engine of destruction. It will be remembered that the British Admiralty attributed the loss of the three battleships to the fact that the Turks let loose, at the easterly end of the straits, a large number of mines, which, coming down with the current, in due course found their quarry.

It would be an interesting *dénouement* of the naval operations of the Dardanelles, if the forts should be taken in the rear and their guns destroyed by field armies. Unless the Dardanelles forts are better protected than our own coast forts against being taken in reverse, or from the rear, the chances of their speedy reduction are very good indeed; but in view of the fact that the fortifications, at least on the European side, can readily be approached by landing parties from ships, it is fairly certain that the landward approaches are capable of offering strong resistance to attack. In which case, it is certain that the Turks, who have proved themselves to be very formidable, when, as at Plevna, they are fighting behind field works and in open trenches, will put up a strong defense. It is likely that the most interesting phase, and certainly the most elaborate, in this attempt to force the straits is yet to come.

Wanted—A Polyglot Scientific Dictionary

OF dictionaries of a strictly lexical character there are two principal types, viz., the dictionary which consists of words with their definitions, and the dictionary which consists of words belonging to one language with their equivalents in one or more other languages. In our superscription we have reference primarily to a work of the second type, though the inclusion of a certain number of definitions, for the purpose of identifying positively such terms as might be ambiguous without them, would certainly be a desirable, and would probably be an essential, feature.

An Italian proverb has it that translators are traitors ("Traduttori traditori"). Reasonably faithful translations are certainly far from common, while perfect translations hardly exist. An unsatisfactory translation does not, of course, necessarily argue either incompetence or negligence on the part of the translator. There are certain insuperable difficulties inherent in his task. Thus, it is impossible to render faithfully into English the turns of expression in other languages for which the English language offers no precise equivalents—and their name is legion. Again, the faithful rendering of a foreign phrase often makes intolerable reading in English and must therefore be avoided.

In contradistinction to these incurable difficulties in the way of good translating, the translator is confronted by one which is not incurable, viz., inadequate dictionaries. Even for the vocabulary of general literature there are very few good interlingual word-books. There is, for example, no good large French-English dictionary, though there are (at last!) some excellent small ones. The average French-English, or anything-else-English, dictionary is notoriously crude and out of date. As to the latter defect, it may be noted that up to ten years ago most "new" and "revised" works of this class failed to recognize the existence of the telephone, while even contemporary publications ignore the existence of a number of every-day expressions (we do not refer to technical terms) connected with that familiar institution.

The situation with respect to the scientific vocabulary presents the anomaly that while, on the one hand, we have some admirable bilingual and multilingual word-books of technological scope, we have nothing of the sort for pure science. A certain recent word-book in six languages, of which about a dozen volumes have been issued, each devoted to a particular branch of technology, is an almost ideal work in both plan and contents, and there are several other good technological dictionaries in two or more languages.

A polyglot dictionary of non-technological scientific terms is an urgent desideratum, not only for the use of translators, but for everybody who has occasion to read scientific literature in foreign languages. What institution or society or individual philanthropist will undertake to supply this need?

War and the Newspapers

AFTER a time one gets used to the vagaries of the newspaper man in handling war news. The old tiresome picture of the body of bluejackets labeled "Marines," with never a marine in sight, hardly provokes a smile, so old and so time-worn is it. We grin faintly instead of emitting howls of unholy joy when we see a picture of 3-inch field guns labeled "Machine guns in action." Even the richest one of the assortment, printed now these many weary months—we refer to the photograph of a parked battery with the gunners lolling comfortably about under the trails and labeled "French (or German or British or Russian) artillery in action"—hardly provokes more than a tickled chortle or so. But we claim that even the most *blasé* of the *blasé* will contort his visage over this extract from an inspired San Francisco paper: "The German troops fire spit balls with a velocity of 2,900 feet per second." All of which makes us wonder whether we had under-estimated the efficacy of the missiles prepared in our youthful days, or whether the German bullet is as merciful as the German disposition is alleged to be. The dum-dum controversy, too, has raged in the pages of the journals. Sometimes inspired editors commented thereon, with results that increased the sale of their papers, and decreased the sale of the intentionally comic weeklies.

A Co-operative Health Board

SEVEN Massachusetts towns co-operate to get an efficient public health service that no one of them could afford to pay for by itself. They abandoned all or part (as they desired) of their other public health resources, and put their medical inspection work in the hands of a central organization under Prof. Phelps of the Massachusetts Institute of Technology.

This seven-town organization (Wellesley, Framingham, Weston, Needham, Melrose, Winchester, and Canton) engaged an administrative officer, a chemist and bacteriologist, a plumbing and sanitary inspector, and a corps of assistants. And these men have all been worth their salaries, many times over. They have regular office hours, which they keep in each of the towns; and they maintain stations at strategic points, from which they distribute such things as antitoxin for diphtheria patients and virus for vaccination. They make diagnoses of diphtheria, typhoid fever, and other infectious diseases by telephone, and then the doctors can go ahead intelligently and treat the patients. That is the way the health of 55,000 people is safeguarded. These seven enterprising towns have as good a health service as is given by many a large city health department, and many a large city is not so well served.

Papers in every hamlet, village and township, from Portland, Me., to Point Lima, Cal., and from St. Augustine, Fla., to Portland, O., please copy.

Electricity

Insulation of Electric Ovens.—In a recent issue of the *Electrical World*, Messrs. A. E. Kennelly, F. D. Everett, and A. A. Prior, described some experiments of theirs upon the heat insulation of electric cooking utensils in which they show what an enormous saving of energy may be obtained by the use of better insulation against the useless radiation of heat. They find that in an oven with single walls the consumption was 40 watts per degree Centigrade as against 25 watts per degree with double walls. When the space between the walls was packed with cotton waste, the energy consumption was reduced to 15 watts while with a packing of mineral wool, this was lowered to between 12 and 13 watts.

Novel Ventilation Indicator for Turbine Driven Generators.—Appreciating the importance of maintaining a constant current of cooling air through a turbine generator, the United Electric Light and Power Company of New York has devised an ingenious indicator to show any interruptions in the cooling current. A pilot lamp is provided in whose circuit is a mercury switch. This switch is held in closed position by a jet of air from the air duct blowing against a vane on the switch. Whenever the air pressure drops, the pressure on the vane is correspondingly lowered and the switch is opened by a counter weight. Thus the pilot lamp is extinguished indicating to the operator at once that there is some trouble with the air supply for that particular generator.

A Surgeon's Divining Rod.—An ingenious method of locating needles in tissues was recently described by G. H. Monks in the *Boston Medical and Surgical Journal*. First the buried needle is magnetized by passing a magnet over the locality where the needle is suspected to be. Then another needle, suspended from a fine silk thread, is passed over the same locality, when the poles of the buried needle will attract unlike poles of the examing needle, causing the latter to swing around parallel to the axis of the buried needle, and if one pair of poles is nearer than the other, there will be a corresponding dip of the examining needle, somewhat after the manner of the "divining rod." By this means the location of the buried needle may be determined with precision. This provides a far simpler and readier means of locating a buried piece of steel than the use of Röntgen ray apparatus.

Vacuum Tube Protection for Telephone Lines.—Writing in a recent issue of the *Elektrotechnische Zeitschrift*, Fritz Schroeter describes a type of vacuum tube which can be used to protect telephone lines against voltages as low as 130. The cathode of the tube is a fused alloy of potassium and sodium, while the anode, consisting of an aluminium rod surrounded by a protective tube, projects down to within a few millimeters of the cathode. The tube contains either helium, neon or argon or a mixture of these gases, at a pressure of one to three millimeters. If by any accident the telephone line should become charged with more than 130 volts, a brush discharge would take place in the vacuum tube, causing sufficient evaporation of the cathode to produce an arc and this would allow sufficient passage of current to melt a fuse in the line. As soon as the dangerous voltage is interrupted, the vacuum tube is automatically restored to normal conditions. By another arrangement the anode of the vacuum tube connects with the line through a coil of high resistance, while the cathode of the tube is connected, of course, to the ground. When the critical voltage is passed current passing through the tube also energizes the coil thereby attracting an armature which opens a switch in the line.

Concentric Wiring.—The question of adopting the European system of concentric wiring is occupying a great deal of public attention at the present time. In Europe houses are very cheaply wired by the use of conductors consisting of an inner core surrounded by insulating material and covered with an outer conductor that is bare. This constitutes the return wire of the circuit and must be thoroughly grounded. In discussing this type of wiring, Mr. S. E. Doane recently pointed out the fact that it is merely an evolution of our present system in this country. The practice of placing the two conductors or circuits within a metallic tube or conduit was necessarily followed by a rule of the National Electric Code requiring that this conduit be continuous from outlet to outlet, and permanently grounded, lest the insulation become abraded and there be a leakage from the conductors to the conduit. But in central stations with a grounded neutral wire, there is practically no difference of potential between that wire and the grounded conduit. Hence the insulation about this neutral wire may be dispensed with or put on the potential wire to increase the margin of safety. Having arrived at this point there is no reason why the bare grounded wire within the conduit should not be dispensed with and the conduit itself be used in its place. Thus we arrive at the concentric wiring. In this connection it is interesting to note that in Germany, owing to the scarcity of copper and rubber, these materials have been largely eliminated from concentric wiring. Soft iron and aluminium have displaced the copper and paper is used in place of rubber for the insulation.

Science

The Publications of the Carnegie Institution amounted, up to the close of 1914, to 276 volumes, aggregating more than 73,000 pages. Of these a total of 132,430 copies had been distributed. As the Institution observes a very conservative policy with regard to the gratuitous distribution of its publications, the above output includes copies sold to the total value of about $94,000.

Pre-historic Man in Australia.—At the recent meeting of the British Association in Australia Professors Edgeworth David and Wilson described a completely mineralized human skull found near Warwick in the Darling Downs of Queensland. It probably dates from a period when the great fossil marsupials were still living and is earlier than any other human remains hitherto found in Australia.

Prices of Chemicals Kiting.—The prices of a very large number of chemicals that have been affected by the embargo on German commerce have advanced tremendously of late, and even at the exorbitant prices quoted there is very little of any of these articles to be had. Carbolic acid has gone from 12 cents a pound, wholesale, to $1.50; salicylic acid from 30 cents to $1.60; phenacetin from $2.75 to $8, and benzole from 75 cents to $4 a gallon. Naturally all potash salts have gone off in proportion, and now permanganate of potash is quoted at 40 cents as against 11 cents of a few months ago, while there is a corresponding shortage and advance in price of other salts of this necessary chemical.

How Timber is Frequently Damaged.—Experiments at the Forest Service laboratory of the Department of Agriculture have determined that the strength of a piece of wood may be seriously impaired by slight compression failures due to rough handling. Dropping a beam across a skid may cause a compression failure at the point at which the beam strikes the skid and it will be at this point that the beam gives way when it breaks under a strain too severe for the weakened fibers to withstand. Hitherto unaccountable breakage in hickory wagon spokes and other presumably strong materials are now attributed to compression failures caused by wind storms in the period of growth or by hard usage in lumbering and manufacturing processes. These compression failures show themselves in the form of little diagonal streaks or wrinkles across the grain, and are always a sure sign of weakness.

The Radio-atmometer.—One variety of Prof. Livingston's porous-cup atmometer, now so widely used for evaporation measurements in connection with plant physiology, is the radio-atmometer, the purpose of which is to measure the effective intensity of radiant energy as this influences evaporation from plant surfaces (as distinguished from the evaporating power of the air itself). This instrument comprises two otherwise similar evaporating surfaces, one of which is white and the other black. The radiation falling upon the former is mainly reflected, while that falling upon the latter is mainly absorbed. The two surfaces are equally affected by the evaporating power of the air; hence the difference between their evaporational losses is an approximate measure of the radiation absorbed by the black one. The results obtained with this instrument are more or less applicable to the study of evaporation from dark-colored plant surfaces under sunshine. Livingston has recently improved this apparatus by substituting spherical for cylindrical cups, thus giving the same angle of exposure to the sun's rays at all hours of the day, and in all seasons and latitudes.

Does Sea-water Contain Free Carbon Dioxide?—The Department of Marine Biology of the Carnegie Institution has recently conducted a number of investigations at its Tortugas laboratory with a view to settling this question. The absence of free carbon dioxide would prove that sea-water has no power to dissolve limestone, and that solution has had no part in the formation of the lagoons of coral atolls and barrier reefs. Numerous samples of the lagoon water of the Tortugas atoll were analyzed by Mr. R. B. Dole, without revealing the presence of any free carbon dioxide. On the other hand, Dr. Shiro Tashiro has reached a different result from tests of this water with extremely delicate apparatus of his invention known as the "biometer," designed especially for studying the rate of metabolism in organisms as measured by their production of carbon dioxide. This device utilizes a drop of barium hydrate, upon the surface of which crystals of barium carbonate form if there be carbon dioxide present in the surrounding atmosphere. It is so delicate that it enables the investigator to detect a quantity of this substance as small as one ten-millionth of a gramme. Dr. Tashiro has made the interesting discovery that carbon dioxide is given off into the atmosphere from the sea-water of Tortugas under normal atmospheric pressure and temperature, and this leads to the suspicion that uncombined carbon dioxide may be present in the water, though the observed phenomena may be due entirely to the decomposition of bicarbonates in the water. The subject is still under investigation.

Aeronautics

A Compounded Aeroplane.—In patent No. 1,127,028 Thomas Alva Edison Lake of Milford, Conn., shows a flying machine in which a plurality of flexible aeroplanes are arranged in step-like order fore and aft and so disposed that no one of the aeroplanes offers resistance to the adjacent one when descending on an even keel.

Flying on the Ground.—A recreation apparatus has been patented by Henry Salsbury of London, England, No. 1,127,094, wherein a car is suspended above a surface and is given motions similar to those of an aeroplane in flight, and animated pictures, taken from mid air, are projected on the surface below to convey the sensation of an aeroplane to the occupants of the car.

Air Compressed by the Parachute Fills the Life Preserver.—Jozsef Vig of Witherbee, New York, has patented, No. 1,131,300, a combined parachute and life preserver in which devices may be operated to cause the parachute to open automatically. In descending air is forced by the descent of the parachute through suitable passages and joints into the life preserver which latter may encircle the wearer in the usual manner so that the operator will be gradually lowered in the water and when in the water will be buoyed by the life preserver.

Another Parachute Attachment for Airships.—Anton Mayer of Chicago, Ill., in a patent, No. 1,125,365, supports a parachute normally housed by a plurality of frame members between front and rear portions of the airship and in operation in case of accident the greater weight of the forward end of the airship will cause such end to dip downwardly. The safety equipment provided enables the aviator to check the descent by opening the ignition circuit of his engine and also effecting the opening of the parachute.

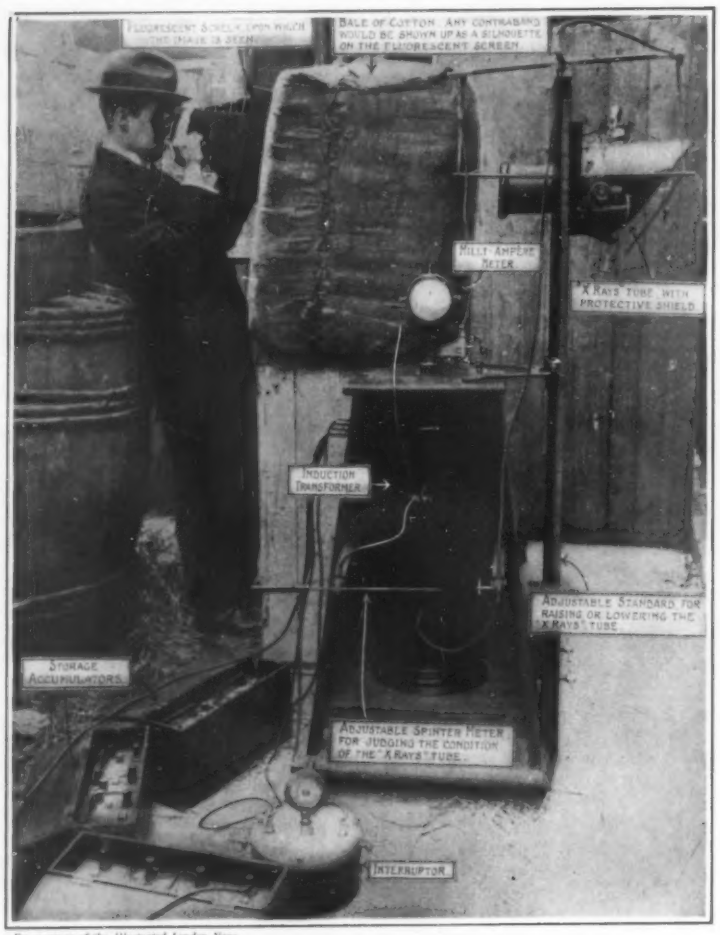
A Speedometer for Aeroplanes.—In patent No. 1,123,253 O. A. Danielson of New York city provides for determining the speed of aerial machines by means of a direct reading instrument which will do for the aeroplane what the familiar speedometer does for an automobile. By his improvement he sights and observes an object on the earth by a movable sight on the aeroplane. Then, as the aeroplane advances, he moves the aeroplane sight rearwardly to such extent as to keep it directly over the earth object, and then determines the speed of rearward movement of such sight necessary to keep it over the earth object and this speed is the speed of the aeroplane.

Aeroplane Operations in the War.—The activity of aeroplanes on both sides during the war has been both remarkable and sensational, not only in the work of scouting and observation, but also in bomb dropping raids, and a noticeable feature of these operations has been the superiority of the French and English machines over those used by the Germans, which have proved greatly deficient in both speed and climbing powers as compared with their opponents. In several instances reported the machines of the allies have fairly outflown those of their adversaries, which were so much faster and could climb so much more rapidly that they were able to outmaneuver the Germans and take positions of such advantage that the only safety of the latter was prompt flight.

Lessons of the War.—According to a statement made by Baron d'Orcy, in France the machines have been divided into three classes: the destroyer, artillery spotter and scout aeroplanes. On each of these lines development is advancing rapidly. The destroyer carries a gun and bomb-dropping machine and is of the pusher type, with propeller behind and gun forward, giving a wide range of fire in attack, and a great advantage over the German 'Taubes," which have the tractor screw in front. On the second class of aeroplanes, the artillery spotters, the needs are light armor, owing to the low altitude at which these machines must fly in observation—as close as 1,000 meters. At this height they can be reached by rifle bullets, and protection from these is needed. The destroyers fly twice as high and need no armor. Neither one of them has had reason to fear the anti-aircraft guns, which are very inaccurate in aim. The spotters also are equipped with wireless apparatus enabling them to keep in constant communication with the batteries to which they are attached. Not all of these instruments are able to receive, but that is not of as much importance as the ability to report the enemy's position and the effect of the fire directed against it. In speed it is important that these machines be able to fly slowly when they wish to linger above a hostile position or suspected position. They also must be able to climb quickly out of danger. So variable speed is being developed. In the third class is the fast light scout, taking the place of cavalry in reconnaisance and bearing despatches that cannot be trusted to wireless. These are one-man machines without armament other than the pilot's rifle or automatic revolver, and most of them are making little more than 80 miles an hour. The higher speed machines have limitations in landing, and there are a very few of them in use, principally in the neighborhood of Paris, which is well protected by aircraft.

Searching for Contraband With X-Rays

WHEN mention is made of Roentgen rays in connection with the present war, we are apt to think first of their use in hospitals to locate bullets, fractures, dislocations, etc., and this is quite natural because there is no doubt that many lives have been saved and much suffering has been avoided by the use of these penetrating rays. But it is not only in the hospital that we find this discovery of Prof. Roentgen put to practical service. The fighting nations are very particular to keep from entering the territory of the enemy any goods that might be used in military service. This entails the endless task of examining all shipments, and the value of any means of seeing through a parcel or bulky package instead of opening it up and examining it in detail is clearly evident. Even in times of peace X-rays were used to examine packages which might contain dutiable goods. Naturally in time of war this method of examination has proved even more important. One of the most difficult of shipments to examine is that of the cotten bale, which obviously cannot be opened and thoroughly inspected and then restored to its original proportions without special baling machinery. What more simple, then, to pass Roentgen rays through it, and by means of a fluoroscope note whether the bale contains any foreign substances? Anything more dense than cotton would be shown up as a silhouette on the fluorescent screen. The accompanying photograph, reproduced by courtesy of the *Illustrated London News*, shows the type of apparatus used in France and in Russia. Even in this country cargoes are X-rayed before being accepted on British ships. Not long ago we illustrated the apparatus used in New York by representatives of the British government. The value of such a search was demonstrated in one case by the discovery of four pounds of rubber sheeting in each of 178 bales of cotton waste. Needless to say, the consignment was refused.


FLUORESCENT SCREEN UPON WHICH THE IMAGE IS SEEN
BALE OF COTTON. ANY CONTRABAND WOULD BE SHOWN UP AS A SILHOUETTE ON THE FLUORESCENT SCREEN
MILLI-AMPERE METER
X RAYS TUBE WITH PROTECTIVE SHIELD
INDUCTION TRANSFORMER
ADJUSTABLE STANDARD FOR RAISING OR LOWERING THE X RAYS TUBE
STORAGE ACCUMULATORS
ADJUSTABLE SPINTER METER FOR JUDGING THE CONDITION OF THE X RAYS TUBE
INTERRUPTOR

By courtesy of the *Illustrated London News*.

Searching for contraband in a cotton bale rendered transparent by means of X-rays.

Wireless Telegraphy and Railroading

By H. D. Schedler

THE Lackawanna Railroad Company undoubtedly is the first railroad company to employ wireless telegraphy successfully. This company first made experiments with the wireless telegraph and telephone in 1909, but the apparatus at that time was crude and not sufficiently developed to be of practical use. Mr. L. B. Foley, who has charge of that part of the railroad, experimented further. During the early part of 1913 towers were erected and wireless telegraph stations installed at Scranton and Binghamton, and it was found that the service between these points was equally as satisfactory as the Morse telegraph, and could be relied upon when the telegraph and telephone service was impaired.

The first passenger train was equipped with wireless telegraphy, and messages transmitted to and from the train and the fixed stations at Scranton and Binghamton on November 21st, 1913. At the present time the company has the following fixed stations:

Location	Call	Wave Lengths in meters	Height of Towers in feet	Capacity of station in Kw.
Hoboken	WBU	3,000	402	5
Scranton	WPT	3,000	175	2
Binghamton	WBT	1,800	165	2
Buffalo	WBS	1,600	150	2

These stations are all equipped with Marconi apparatus.

Besides these fixed stations several of the limited trains are equipped with sets. The apparatus aboard the trains are similar in principle to that of the fixed stations. The motor generator on the train is operated on 30 volts direct current from the car lighting generator, which carries on its line a set of storage cells. This motor generator draws about 40 amperes, and supplies 500 cycle alternating current at 250 volts for the radio transmitter, including a 10-unit quenching gap, three glass jar condensers of suitable capacity each, and the usual radio transformers.

From a moving train to a fixed station a distance of 130 miles can be covered. Owing to the low antennae on the passenger cars, a greater distance than this has not been covered, but messages have been received from a fixed station over a distance of 200 miles. The aerials on the trains must be low on account of bridges and other overhead interferences. The speed of the train, or its change of direction while *en route*, does not have any effect upon the transmission and reception of signals, and it is queer that communication to and from the train is not impaired while the train is passing through tunnels.

The train radio service has been used for various purposes, such as reporting the number of passengers on board destined to connecting lines, for providing additional, or cutting out cars at divisional points, in ordering an ambulance at next train stop for persons taken ill on a train, and handling commercial telegrams for passengers. In one instance a telegram was filed by a passenger on the train for a resident in the city of Scranton, the message transmitted to its destination, delivered, and the reply received by the sender in twenty minutes.

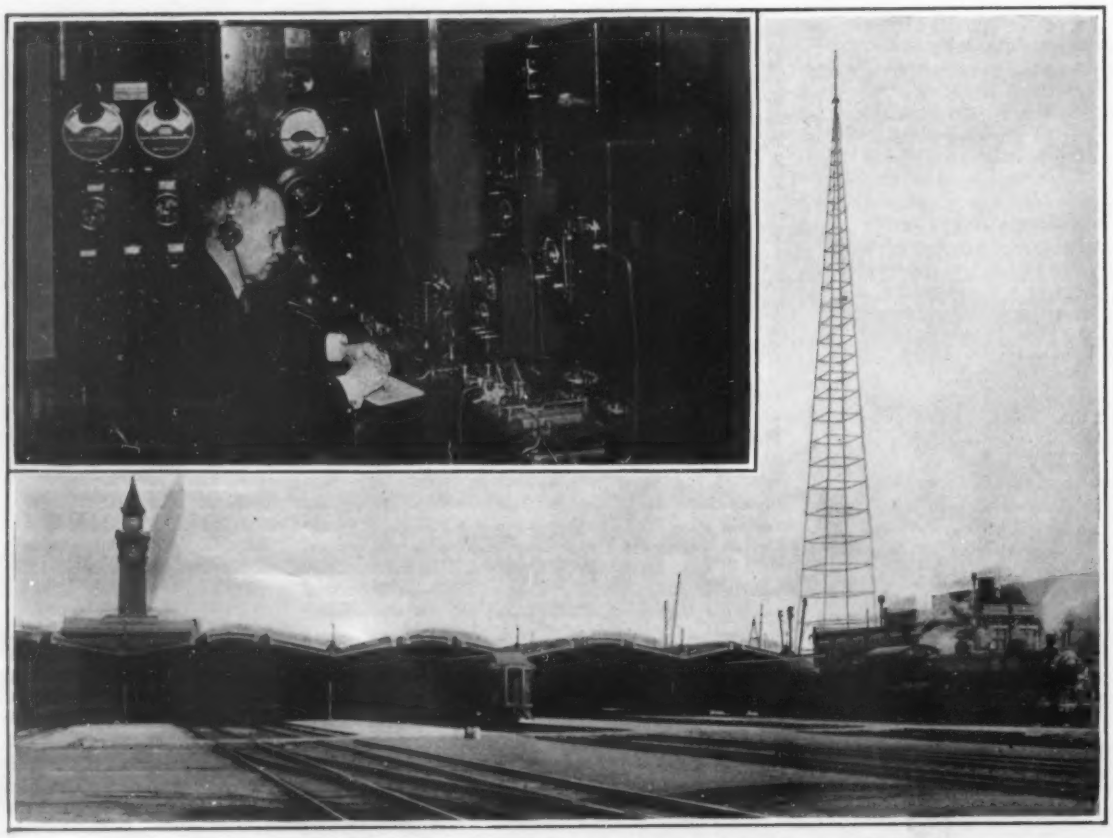
On April 1st last year a special train equipped with wireless telegraph, ran from Ithaca to Hoboken, carrying 550 Cornell students. The train operator handled 128 radiograms from the train to fixed stations at Binghamton, Scranton, and Hoboken, for students who were on their way to their homes for Easter.

The wireless telegraph can be depended on between fixed stations and between moving trains and fixed stations. There are many uses for the wireless telegraph in railroad train operation. It enables the dispatcher to communicate direct with the train, and train orders can be transmitted as accurately and reliably as by telegraph or telephone.

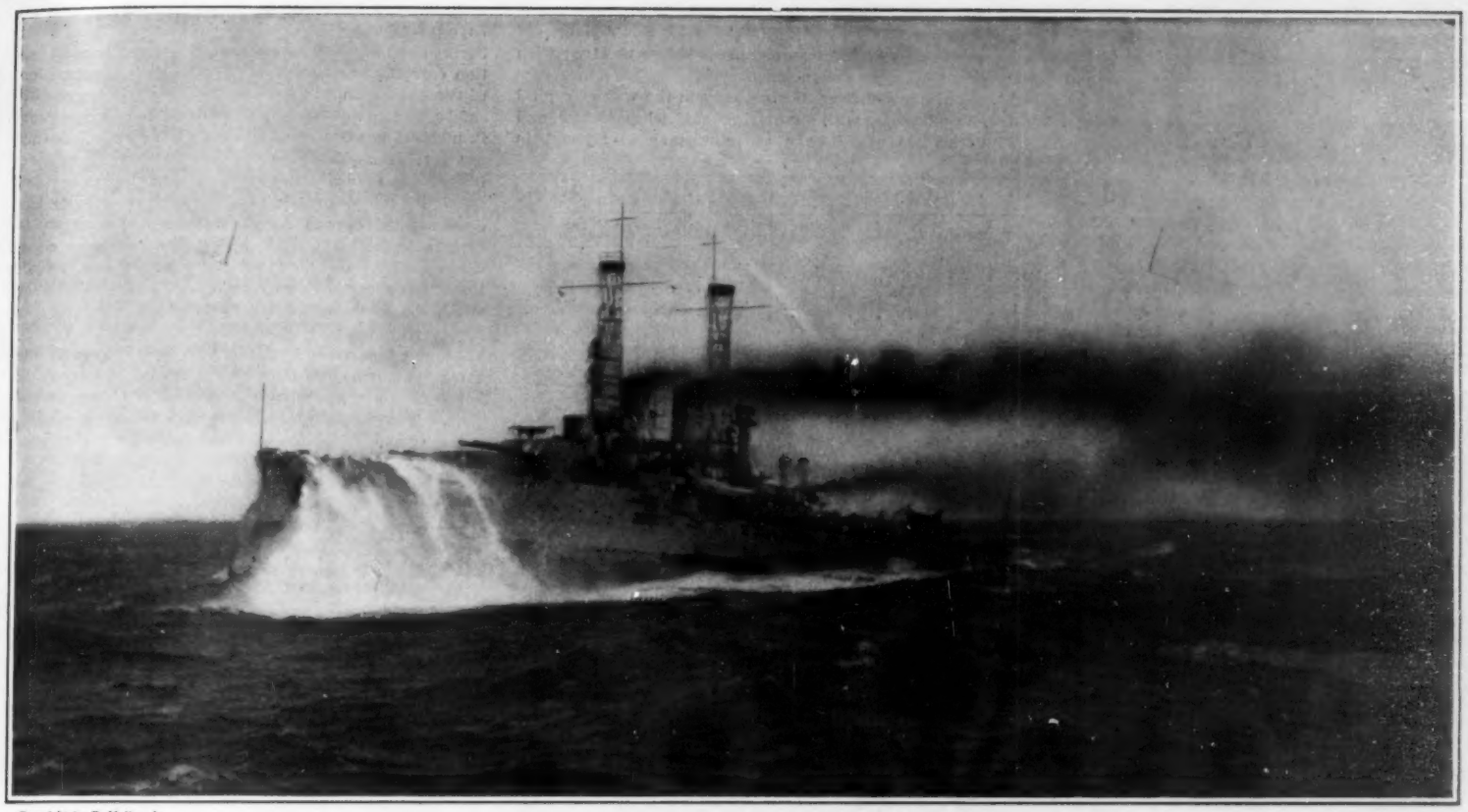
The wireless telegraph serves as an auxiliary method of communication, in addition to the telegraph and telephone, in the event of interruption to wire facilities, and has already proved its practicability and efficiency under such conditions, not only between fixed stations, but also between moving train and fixed stations, and the results obtained by the Lackawanna Railroad during the past year have been valuable in many ways. It is the intention of the company to extend the service over the entire system.

Each station (wireless) at each divisional point is located within a few feet of the dispatcher's office; and in event of total wire failures on any part of the road, the wireless station is immediately resorted to. Operators at divisional

(*Concluded on page 349.*)



Running a railroad by wireless. The wireless equipment of the Lackawanna Railroad.



Copyright by E. Muller, Jr.

Date, 1911. **Tons,** 21,825. **Speed,** 21 knots. **Guns,** Ten 12-inch, sixteen 5-inch. **Torpedo tubes,** 2. **Belt,** 11-inch.

U. S. S. "Utah" driving into a heavy head sea in the North Atlantic.

An Analysis of Our Naval Standing—I

Strength of United States Fleet has been Determined by Temporary Emergencies

By George von L. Meyer, Former Secretary of the Navy

FRANCE, fourth as a naval power last year, has taken the place of the United States, the French government having expedited work on all ships which were in process of construction at the time the war began. The Naval Intelligence Office announced, last July, that if all vessels then building were completed French tonnage would be greater than that of the United States.

On our part, we are not even following a programme of new construction intended to replace those vessels which have been, or will soon be, condemned because unfit for service on account of age. A feeble attempt has been made to convince the public that the Panama Canal *doubles* the fleet, but this is an absurdity. It has also been said that by the time the present war is concluded the United States Navy will be the first, the losses of the belligerents relegating them to lower rank in tonnage. Yet experts of the Navy Department refuse to consider this decrease by attrition as indicating a relative increase for the United States, because what counts is not the number of ships lost, but the number of those being added to the outstanding fleets. There is no hope, therefore, that we can increase our tonnage by a corresponding decrease in the tonnage of the other naval powers. Furthermore, these losses may remain relatively insignificant, if viewed in the light of the naval strength of the belligerents. Up to the time of writing the engagements of the battle cruisers in the North Sea and off the Falkland Islands have been the only naval encounters of any consequence, but yet inconsequential in mere tonnage.

The most serious thing about our interests in the Navy is that the advocates of the "biggest" navy and the advocates of "no navy" are not defeating each other in the legislative debates on the naval appropriation bill, but they are defeating all attempts to discuss intelligently the topic of national defense.

Personally, I am not committed to a great navy. I am, however, in favor of a strong fleet with all necessary auxiliaries. The situation in the United States to-day, when even neutral American shipping is in danger, should warn us that preparedness is a wise thing, and that we can never hope to expand our foreign commerce without an adequate navy to protect it.

Our fleet, as it exists to-day, is the growth of an inadequately expressed public opinion, and that growth has followed the laws of expediency to meet temporary emergencies and has had little or no relation to the true meaning of naval power, or to our need of naval power. The naval policy of the United States should be to possess a fleet powerful enough to prevent or answer any challenge to the country's well-established national policies. It is obvious that the absolute strength necessary to accomplish this is a question that depends upon the national policies of possible challengers and the force that they can bring against us. This force is relative and varies with their naval policies and building programmes. Briefly, our fleet should be the equal or superior to that of any possible enemy, and in order to arrive at any satisfactory conclusion on this debatable point, we must base our calculations upon the careful estimates and forecasts of the General Board as to what would be the naval development of those foreign countries with which conflict might be probable.

In 1903 the General Board formulated its opinion as to what our naval development should be, and its forecast was that a fleet of 48 battleships, with the attendant lesser units and auxiliaries, ready for action by 1920, would accomplish this result. This forecast has proved, after many years, remarkably accurate. Meanwhile the absence of any definite naval policy—which means congressional opposition to the recommendations of several administrations—has lost us second and then third place, and if continued will make of us an inferior naval power.

During my incumbency as Secretary of the Navy in the Taft Administration, congressional opposition to the Navy Department's recommendations was generally based on the theory that the United States will *never* have a war. But history shows that wars come at times with little or no warning. The European war was an actuality overnight and in ten days as many nations were allies or enemies in what will be the most titanic struggle known to man.

A force of circumstances, over which the United States has no control, is beginning to involve the safety of the lives of American citizens as well as the protection of our interests. Yet we must not forget in this instance that our Navy is the arm and measure of strength of our foreign policy and diplomacy, and a deficient navy will weaken both this diplomacy and policy.

The war has shown us that, commercially, financially and industrially, we are not isolated from Europe, to say nothing of the rest of the world, and the opening of the Panama Canal lessens this isolation because it brings so much foreign shipping almost at our door.

In estimating upon a fleet of forty-eight battleships of the line, with the appropriate number of lesser units and auxiliaries to complete and maintain a fighting whole, and a personnel of officers and enlisted men that shall grow and keep pace with the material fleet, the General Board tentatively figured that this full strength be attained by 1920. But although Italy's naval programme extends to 1918, France's to 1920, Germany's to 1917, and England's existing law is to develop a supremacy of 60 per cent in vessels of the dreadnought type over Germany, the American procedure has been to reduce and disregard to a great extent the recommendations of the General Board and those of the Navy Department when in sympathy with the General Board and thus fail to meet the needs and requirements of the Navy. It will be impossible for the board's plans to be realized by 1920, because the estimates and recommendations for 1916 have already been submitted, and judging by present indications the United States will gain little in the next four years.

The building programme recommended this year differs little from the recommendations of last year. Secretary Daniels follows the policy recommended by the General Board, but reduces the number of vessels asked for. His estimates include two dreadnoughts, six destroyers, eight submarines (one sea-going and seven coast-defense), one gunboat and one oiler. The General Board recommended to the Secretary of the Navy four battleships, sixteen destroyers, three fleet submarines, sixteen coast submarines, four scouts, four gunboats, two oil-fuel ships, one destroyer tender, one submarine tender, one navy transport, one hospital ship, one supply ship, and aerial service to the extent of $5,000,000.

Granting that this programme be repeated for the next four years, the United States would in 1920 have forty-eight battleships, if replacements be not considered or no age limit be placed on such vessels. But a navy must be renewed every year, unit by unit, because warships become obsolete after twenty years. A new warship substituting an old one does not increase naval strength, though it may add a few hundred tons to the total, but merely enables a nation to retain her normal naval strength with modern equipment.

Nor can it be for a moment conceded that the Panama Canal will double the fleet, as it has often been stated. The canal will increase the efficiency of the fleet somewhat because it will reduce the time necessary to move a given number of ships from one coast to another, but this rapidity of movement is not the equivalent of a numerical increase of units. The actual advantage of the canal and its value to our Navy is something that can be deduced only in theory, for it involves problems of strategy and warfare with which this article has nothing to do. The Panama Canal will, in effect, be a

naval base, since the docking and repair facilities to be provided there for commercial vessels will meet our naval requirements in time of war. And this leads us to the question of naval bases, to which I shall refer in due time.

The naval standing of the powers last July was as follows:

	England		Germany		U. S.		France		Japan		Russia		Italy		Austria	
	Built.	Bldg	Built.	Bldg	Built.	Bldg	Built.	Bldg	Built.	Bldg	Built.	Bldg	Built.	Bldg	Built.	Bldg
Battleships (Dreadnoughts)	20	16	13	7	8	4	4	8	2	4	..	7	3	7	3	4
Battleships (Pre-dreadnoughts)	40	..	20	..	22	..	18	..	13	..	7	..	8	..	6	..
Coast-defense	..	..	2	..	4	..	1	..	2	..	2	..	..	..	6	..
Battle Cruisers	9	1	4	4	..	..	..	..	2	2	..	4	..	..	..	..
Armored Cruisers	34	..	9	..	11	..	20	..	13	..	6	..	9	..	2	..
Cruisers	74	17	41	5	14	..	9	..	13	..	9	8	6	..	5	5
Destroyers	167	21	130	24	51	11	84	3	50	2	91	44	36	15	18	..
Torpedo Boats	49	..	..	..	13	..	135	..	27	..	14	..	68	2	39	24
Submarines	75	22	27	18	30	19	64	22	13	2	30	19	19	8	6	6

The foregoing table refers only to the completed tonnage, according to the records of the office of Naval Intelligence. On this basis, we occupy third place, but on the basis referred to at the beginning of this article, that of vessels in actual construction if completed, we fall back, yielding our place to France. At all events our tonnage of 765,133, compared with France's 688,840, is susceptible of reduction because our figures include the "Iowa," which will soon be retired. This ship must be replaced, because in armament, protection, speed and other qualities she is not fit to take a place in the line of battle. Needless to say, the "Indiana," "Massachusetts," and "Oregon" are no longer included in our tonnage list. The "Kearsarge," "Kentucky," and "Alabama" will reach their age limit in 1916, while the "Illinois," "Wisconsin," "Maine," "Ohio," and "Missouri" are due for replacement by 1920.

The lowest estimate which the United States Government should consider in the way of a naval programme is, in my opinion, three battleships, twelve destroyers with their tenders and the full quota of auxiliaries. If we build two battleships a year we shall remain, according to the figures available, in the fourth place, provided France does not lose any ships in the course of the present war, but we must bear in mind that the great powers, especially England and France, are maintaining strict secrecy as to their naval increases.

It is obvious, therefore, that our programme will lead nowhere if it is truly the purpose of our people to have an adequate navy. The present fiscal year has been an exception because though Congress appropriated funds for two battleships, a third was made possible by the sale of the "Idaho" and "Mississippi" to Greece last spring, using the funds derived from this transaction for an additional dreadnought. But the "Idaho" and "Mississippi" were both modern ships, built in 1904, and though getting rid of them was a good business proposition, it does not appear that it will increase our tonnage.

Nowadays only dreadnoughts are considered by first-class powers in estimating strength in the first line of battle. Capital ships include the new type of armored cruiser. England and Germany have featured this type of vessel, while Japan has recognized its value, and the latter's programme two years ago called for four armored cruisers and one battleship, reversing the German programme of three battleships and one cruiser. These cruisers are not so heavily armored as the battleship, but they carry big guns and have a speed of 28 knots; they can outspeed anything in order that they may destroy the commerce of the enemy and not be overtaken by a battleship. It is very true that the "Emden" in three months inflicted considerable damage to British shipping in the Pacific and Indian oceans, but the little German cruiser was always in danger of meeting a stronger adversary, as it eventually did. The "Sydney" could never have successfully engaged the "Emden" had the latter been a 28,000-ton battle-cruiser.

The Navy Department has recognized the value of this new type of vessel, but has not systematically recommended its adoption in our Navy owing to our comparatively inferior strength in battleships of the dreadnought type, but while remedying this deficiency this country should also begin to build battle-cruisers, equal if not superior to those of foreign navies. The inclusion of such vessels in this country's building programme is most desirable, but it should be authorized in addition to the battleships needed to maintain our present battleship strength. Having an adequate number of battleships of the first class is the most economical programme in the end. It may be pertinent to remark that if we had had four more battleships like the "Oregon"—an expenditure of about $25,000,000—there would probably have been no war with Spain and we would have saved over $500,000,000 and the lives and property that were lost.

Our Navy, therefore, especially in battleships of the first rank, does not occupy, as can be readily seen, a permanent third place, and while the numerical strength seems to leave nothing to desire, it must be remembered that it is made up of many ancient vessels and others which have reached their limit of usefulness and should be replaced. Provision for this replacement is one of the urgent requirements before us if we wish to maintain a modern navy.

But our deficiency lies not only in the way of capital ships, but also with auxiliaries, matériel, personnel, and docks. It would be a grave mistake to attempt to strengthen ourselves with additional battleships without adequately providing for the requisites that each additional capital ship makes indispensable.

The following are the proportions of the various units needed for a complete fighting fleet: to eight battleships there should be 32 destroyers, 16 submarines, 1 ammunition ship, 2 destroyer tenders, 4 fuel ships, 1 hospital ship, 1 repair ship, 2 submarine tenders, 1 supply ship, and 1 transport. No definite number of hydroplanes has been agreed to, but the board has recommended at various times that no limitation be placed on the number of airplanes to be built each year until the sufficient number for the existing fleet has been reached.

It is very true that ship for ship and man for man our Navy is the equal to any other navy in the world. But it is none the less true that we are not discussing the relative merits of naval units or of individuals that constitute the personnel of the world's navies. We are discussing the Navy, which means the total number of available battlecraft and personnel and, inferentially, all that goes to make up the naval establishment of a great power.

Proceeding from this point, there exists a deficiency in our Navy, as a whole, which ought to be remedied as soon as possible. In order to arrive at a better understanding, the following chart will show what the deficiency is. For the purpose of the comparison ships under construction or authorized will be considered as though available.

Type	Number of ships available	Under construction or authorized	Total	Number necessary on basis of 42 battleships	Deficiency
Dreadnoughts	8	7	..	...	...
(Pre-dreadnought) ships[1]	27	..	42	..	..
Battlecruisers	..	..	..	10	10
Arm'd cruisers[2]	10	..	10	..	..
Scouts	3	..	3	42	39
Destroyers	50	18	68	164	96
Tenders	6	3	9	20	11
Repair ships	1	..	1	5	4
Supply ships	4	1	5	5	..
Hospital ships	2	..	2	5	3
Ammun'on ships	..	..	..	5	5
Fuel ships	22	2	24	24	..
Submarines	30	28	58	88	30
Transports	5	1	6	5	..
Totals	168	60	228	373	198

[1]Includes old-type battleships.
[2]Armored cruisers have been superseded by battle cruisers; those on hand would be employed as scouts.

The deficiency existing July 1st, 1914, including as it did the building programme of 1914-1915, is the deficiency that exists to-day. As the estimates submitted by the Navy Department for 1915-1916 provide, besides two dreadnoughts, for 6 destroyers, eight or more submarines, one gunboat and one oil-ship, it will be readily seen that the deficiency of about 200 auxiliaries will remain with us for some time.

The foregoing table is based upon a fleet of 42 battleships, which includes the "Iowa." The "Iowa" will be twenty years old next year and must be substituted with a new and modern warship. The "Kearsarge," "Kentucky," and "Alabama" will also reach their age limit within two years, and their tonnage must be replaced.

It is obvious that the programme of two battleships a year will not, for the next few years at least, provide an increase in our Navy, but merely for its modernization. The ships retired can no longer be computed in effective tonnage statistics. A three-battleship-a-year programme would permit an actual increase in effective battleship strength, but certainly not to the proportions recommended by the General Board nor by 1920.

The United States has no battle-cruisers. To neglect them further would mean a deliberate weakening of our naval strength, because such vessels have a military value not possible to obtain from other types or combinations of types. The policy of four destroyers for each battleship was advocated by the board in 1907 and consistently adhered to since then. The ratio is considered essential to a proper balance of the fleet, while tenders in the proportions of 1 to 16 destroyers have become indispensable fleet auxiliaries. The United States has now only one makeshift vessel for ammunition carrying purposes, and therefore the construction of standard ammunition vessels cannot be delayed with safety, and five of them are required. We possess an insufficient number of gunboats to perform effectively the service required for the protection of American interests in Central American and West Indian waters, as well as in the Far East. The present war has demonstrated beyond all doubts that the gunboat is invaluable for coast work, and the British have effectively used these ships along the Belgian coast. Additional sea-going tugs would be invaluable, and they should be furnished on the basis of one tug to every four battleships.

Inasmuch as there is no limit to the number of submarines that may be built in any one year, it is to be hoped that our shortage of 30 will be remedied in due time. The submarine is a most effective defensive weapon, and Germany has used it with remarkable success as a weapon of offense. In this line it offers great possibilities for development. But submarines will not, at the present time, decide any naval war. The ultimate test of strength is the total number of battleships of the first line. To-day, in number of submarines, the United States Navy stands third.

First Aid for the Cigar

BEFORE a man lights a cigar he always has to cut or bite off the end in order that the cigar will draw well. Even then the cigar occasionally does not smoke as it should. To remedy these defects a certain cigar maker cuts off the end of the cigars which he manufactures and inserts a large pin about two inches in length and provided with a head similar to the tip of the cigar which was removed. The pin is the same color as the cigar and in no respect detracts from the appearance of the article. In fact, the casual observer would not notice it. As a first aid to improve the smoking qualities of the cigar it is highly efficient. The consumer merely pulls the pin from the end of the cigar and then enjoys a perfect smoke. He doesn't have to bite off the cigar end and he doesn't have to fuss with the cigar to get it to smoke evenly and to draw well. This handy scheme has delighted all smokers who have tried it.

The Current Supplement

ALMOST valuable article in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2049, for April 10th, 1915, is "The Life Study of Patients," which points out the desirability of knowing something of the previous pathological history of the patients in order to understand the real causes of the ailment to be treated, instead of acting on the temporary symptoms. The important paper on the Influence of Radio-Active Earth on Plant Growth is concluded. Saving Sunken Submarines is a timely account of the provisions that have been made by foreign countries for the salvage of these craft in case of accident and the rescue of their crews. The account of the industrial development of the United States as told in the Record of Achievement is concluded. There is an interesting technical history of the Liberty Bell, in Independence Hall, in Philadelphia. The new aircraft that cost Lincoln Beachey his life is described and illustrated. There is a valuable article on Gyrostats and Their Lessons. What Everyone Should Know About Cancer sounds a timely warning in regard to this widespread and dangerous disease, and conveys most useful information to the lay reader. The advice on the Use and Care of a Watch will interest everybody. Of interest to the general reader are the notes on Eugenics and War. The note on Color Sensitized Plates will add to the photographer's knowledge.

Back Numbers of the Scientific American Supplement

WE beg to advise our readers that we have discontinued selling numbers of the SCIENTIFIC AMERICAN SUPPLEMENT dated earlier than January 1, 1914. We removed the first week in April to the Woolworth Building, New York city, and the change in our offices precluded the carrying of issues of the SUPPLEMENT extending over a period of nearly forty years. It was, therefore, necessary to turn over this portion of the business to someone who has space for carrying so large a stock. The H. W. Wilson Company of 39 Mamaroneck Avenue, White Plains, N. Y., have been chosen to take care of our back number business. They have the complete stock and are ready to supply any of the back numbers at the standard price of 10 cents. We, therefore, request that, in future, all orders for SUPPLEMENTS be sent direct to the H. W. Wilson Company instead of Munn & Co. Please do not order SUPPLEMENTS on letters ordering subscriptions for the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT or books, or containing any other matters.

An Important Development in Color Photography

The Kodachrome Process of Color Portraiture

IN addition to one or two processes which are only of laboratory interest, all methods of color photography consist of applications of the three-color theory of vision, depending on the fact that any color can be matched by a combination in the proper proportions of the three primary colors—red, green, and blue-violet. There are two main methods by which the combination of these colors can be achieved and a color picture produces, these being termed, respectively, the additive and subtractive methods.

The original process used by Clerk Maxwell in his famous lecture at the Royal Institution in 1861 was an additive process, for he projected on a screen three lantern slides made from three negatives taken of a colored ribbon by means of three lanterns in front of which were glass troughs, these containing, respectively, sulphocyanide of iron, which is red, chloride of copper, which is green; and ammonio-copper sulphate, which is blue-violet in color. The three negatives from which the lantern slides were made had already been taken through the same three solutions. The lantern slide taken by red light was projected by red light, that from the negative taken by green light was projected by green light, and that taken by blue light was projected by blue light, the three pictures being superposed on one another, so that a colored image was seen on the screen, of which the report says: "If the red and green images had been as fully photographed as the blue, it would have been a truly colored image of the ribbon." This imperfection of Maxwell's result was undoubtedly due to his lack of photographic material appreciably sensitive to any colors other than blue-violet.

Since this first experiment the additive process of three-color projection has been used by many workers, the best known being Ives in his famous "Kromskop," which he modified so that the principle could be used both for projection on a screen and also as a view instrument to be used by an individual observer.

One of the latest applications has been the Gaumont three-color process, where three kinematograph pictures are taken on film of the usual width, one over the other, through three lenses, the pictures being somewhat reduced in height so that the three pictures are two and a quarter times the length of the ordinary black and white picture, the film being moved after each exposure through the length of the three pictures. Projection is accomplished by means of a very ingenious triple lens, each positive being projected through its own lens system and filter, and registration effected by moving two of the lenses.

An entirely different application of the additive process of color photography is found in the screen plates, of which the best known example is the Lumière autochrome plate. The possibility of this method was first indicated by Ducos du Hauron in 1869, in the little booklet entitled "La Photographie des Couleurs," in which he outlined many of the processes of color photography which have since been realized in practice. The principle of the screen plate process is to divide the surface of the plate into a number of microscopic filter units—red, green, and blue-violet—and then to take the picture through these units upon an emulsion from which a positive is made either by reversal or by the ordinary photographic methods, this positive being registered with the screen, so that where the emulsion was blackened by exposure through one of the filter units, light is transmitted through that unit in the finished picture. Suppose, for example, that a red object is photographed on a screen plate. Then, where the image of the red object falls, light will pass through the red filter units and will affect the emulsion beneath so that it will be blackened after development, while where the emulsion was protected from the red light by the green and blue units which absorb it, no effect will be produced. Now, if the developed negative be converted into a positive, the portions of it under the red filter units will be transparent, while those under the green and blue filter units will be opaque, so that in viewing the picture the red object will be represented only by the red filter units, the other units being blocked out, and will consequently appear red. The Lumière plate represents this process in its simplest form, the filter screen being coated upon glass and the emulsion on top of the screen, while the negative itself is reversed and converted into a positive, so that it remains always registered with regard to the screen.

These additive processes of color photography, however, have some disadvantages. The projection system, while admirable for the illustration of lectures, is inconvenient for any other purpose, while the screen plates by virtue of the presence of the filter screen are necessarily dark, and the introduction of the filter screen introduces limitations as to definition and quality which are not altogether desirable, so that the subtractive processes, although on the whole they are more difficult to work than the additive, have always been considered as offering many attractions.

The subtractive processes depend upon the generation of colors by the superposition of the three complementary colors—blue-green, magenta, and yellow. Where magenta is superposed by yellow, we get primary red, the yellow absorbing the blue and the magenta the green light, so that only the red constituent of white light is left. Where blue-green is superposed upon yellow we get green, the blue constituent being absorbed by the yellow and the red by the blue-green, and where magenta is superposed upon blue-green we get blue-violet, the red being absorbed by the blue-green and the green by the magenta. Consequently, by superposing the three in the requisite proportions, all colors can be reproduced. The method adopted in practice is to make three negatives through the three color filters just as in the additive process, and then to print positives from these negatives in such a way that the image consists of a colored dye, the commonest method being to print the negatives in bichromated gelatine. Gelatine containing bichromate and exposed to light becomes insoluble in hot water where the light has acted upon it. Consequently, if a piece of paper coated with gelatine containing bichromate is exposed under a negative and then the film of gelatine is transferred onto another piece of paper or a piece of glass and the back of it washed with hot water, the gelatine will be left in its full thickness where the light has acted strongly and has penetrated right through to the back of the film. Where the light has not penetrated completely through the film, the gelatine will be washed away so that its thickness will be in proportion to the extent of the light penetration; that is, it will be a complete positive printed from the negative. This film of clear gelatine will, of course, be almost invisible when dried, but by immersing it in a dye solution, the dye will take in the proportion to the amount of gelatine, and a color positive will result. The three negatives are printed by this process, the negative taken through the red filter being printed on gelatine which is dyed blue-green, the one through the green filter on gelatine dyed magenta, and the one through the blue filter on gelatine that is dyed yellow. When the three colored transparencies are cemented together on the top of one another, the result completely reproduces the colors of the original object. This transparency may be viewed in the hand or examined in front of an artificial light or projected in a lantern, or instead of this, a paper print may be made by stripping off the three gelatine reliefs on paper; and some very beautiful results have been obtained in this way. The only objection to this process is that it is not at all easy to work. The making of the three negatives itself offers no difficulties, but the printing and dyeing of the gelatine reliefs, so as to get them printed alike and developed to the same extent, has made the process too intricate to be a commercial success.

Obviously, one step in simplification would be the substitution of two colors for three. This has already been done in the Kinemacolor additive process of color kinematography, where two negatives are used—a red and a green—and positives from these are projected alternately upon the screen, through red and green filters. The color rendering in this process is quite pleasing, although the correctness is much inferior to that of the three-color process, but the results obtained are sufficiently encouraging to justify the belief that a slight improvement in color rendering over the results obtained by this two-color additive process would be quite satisfactory for many purposes. Now, an investigation of the colors produced by the addition by superposition in projection of two nearly complementary colors has shown that a serious limitation to the range of color which can be produced is imposed by the necessity that the two colors used in the additive process should be nearly complementary to one another, because the whites are produced by the two colors together in full strength, and unless they are nearly complementary, pure whites will not be obtained. On the other hand, in a two-color subtractive process the whites are obtained by the absence of either of the colors, while in the case of full black, the colors would be of such strength that almost any color would be satisfactory. Colors can consequently be used which are not exactly complementary, and under these conditions a very much better range of colors can be obtained than is possible with the additive process, so that a two-color subtractive process should theoretically give a color rendering which, while not so good as the three-color process, should be better than the two-color additive process, and would probably be sufficiently pleasing for most purposes. Clearly, the simplest possible subtractive process will be one in which the original negatives themselves are directly transformed into color positives; therefore, the simplest possible color process will be one in which two negatives taken under two filters were directly transformed into the partial pictures for the two-color process, the red negative being turned into a green positive and the green negative into a red positive, and the two then superposed face to face to make the completed picture. Such a process would employ no loose films and only the minimum number of glass plates, while there would be no transferring of pictures from one glass to another. The final difficulty of registering also is reduced to a minimum. Moreover, if the original negatives can be actually transformed into a color positive, we may expect to retain in the positives all the gradation in the original negatives. The gradation by this process should consequently be as good as can possibly be obtained. Also, since there is no screen and the high-lights are represented by clear, unstained gelatine, the transparency of the picture should be equal to that of a black and white subject.

It will be noticed, however, that this proposed method of working involved one very big step which had never yet been solved, namely, the direct transformation of a negative in black silver into a positive in which the silver of the negative was represented by clear gelatine and the places that were lightest in the negative by a full strength of any colored dye that might be chosen, the transformation being correct throughout, so that all the gradation of the original negative was reproduced in the resulting positive. It was this specific problem of transforming a silver negative into a dye positive, the working out of which made the new two-color process possible. Although the solution now appears simple, it involved a great deal of experiment, small changes in the procedure having much influence on the result, so that a satisfactory process was only achieved by continual experiments and changes in working.

The method adopted is to make the negatives on specially prepared panchromatic plates and through the correct filters, and then develop them as usual. They are then chemically treated so as to remove the black silver and leave the plate looking just like a colorless sheet of gelatine, showing no sign of an image. When this plate is put into the specially prepared dye bath, the dye goes into the gelatine most easily where the silver was absent in the negative; that is, where there was least light in the original photograph or in the part represented by deep shadows; while in the parts corresponding to the high-lights, where there was much silver in the negative, the dye penetrates more slowly, so that as the dye slowly enters the film, the original negative is transformed into a positive produced in a colored dye. While the one color is made in this way, the companion picture is also dyed in the other color, and the two, when placed together, make the finished picture. The process is thus seen to be simplicity itself, the novel point of it being the method which has been worked out for transforming a black and white negative image into a colored dye positive. Since only two colors are used in the process, it is obvious that all colors cannot be correctly rendered, and the colors for which the process fails are the blues, violets, magentas, and purples. Light blues appear blue-green, and violets, black; magentas appear pink; and purples, dark brownish-red. On the other hand, flesh tints of all kinds, and all shades of red, orange or green, grays and blacks are well rendered. As these are predominant in portraits, the results are very satisfying for this class of work. Many of the pictures appear to show blues very well, but this is because by contrast with greens, blue-greens look blue, and especially by artificial light the eye is accustomed not to expect very much of blues. The failure in color rendering is more obvious by daylight, and because of the importance of greens and blues in most landscapes, the process is not suitable for landscape work. The pictures appear at their best when placed in a special illuminator, giving a much truer color rendering than when viewed by daylight. The results obtained are permanent, the colors being fast both to light and heat.

For the practical work of this process it is necessary to have a powerful light in the studio, and experience has shown that the plates can be best worked by the use of artificial light. For this reason a special electric lighting system for working the process has been designed. A camera may be used by which one of the negatives is reversed in position compared with the other, so that when the two plates are put face to face, they will register. Or the pictures may be made in an ordinary camera to which a repeating back has been

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A Submarine to Salve a Submarine

How One Underwater Craft Could Aid Another in an Emergency

By Robert G. Skerrett

THE foundering of the "F-4," harrowing as it is, shows how lucky we have been in the past compared with other nations with flotillas of submarines. This catastrophe likewise emphasizes how needful it is that adequate salvage facilities be provided for just such emergencies. Fortunately, this is not a hopeless task, and the object of the present article is to call attention to one of the most promising of these life-saving equipments and, withal, one of the simplest.

The men responsible for the invention, Messrs. Sloan Dannenhower and W. W. Wotherspoon, have had between them years of familiarity with submarine service and notable salvage operations. Their aim is to rescue the men imprisoned in sunken submarines, and, as they put it, "If life is present in a disabled submarine, that life can be saved and saved quickly, in any weather short of a gale, by means of our equipment. The apparatus is simple, light, compact, and instantly available. It consists of a combination of devices which separately have been in successful use in submarines of various types for years. In addition to these, other devices have been invented and supplied, which render the combination capable of easy and sure operation."

The German salvage vessel "Vulkan." Can lift 500 tons 80 feet in an hour.

In short, the object is to make the position of the sunken craft known to vessels on the surface, to facilitate immediate life-protecting aid, and then to provide means by which the damaged craft can be salved through the agency of another submarine equipped with similar apparatus. Essentially, the outfit consists of a detachable marker buoy provided with an air hose connection to the sunken boat and means for coupling that line with the air service of another submarine at the surface, the buoy carrying also an electric signal light and a telephone installation by which communication can be established with the foundered vessel.

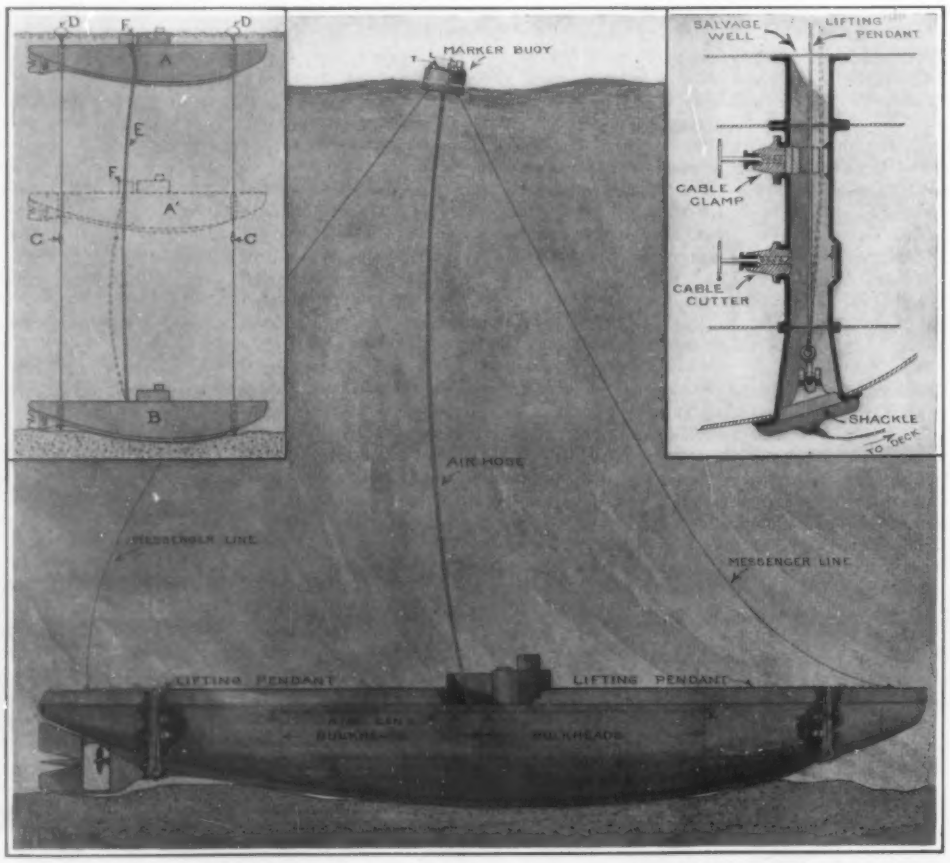
In rising to the surface, the marker buoy carries with it two messenger lines of light bronze cable, which, in turn, are secured to the heavy lifting pendants which are equal to sustaining the load represented by the sunken submarine. These lifting pendants would average 125 feet long with eyes at their upper ends and detachable shackles and pads at their lower ends. The salving submarine would have a like installation, and the method of operation for the relieving craft would be as follows:

The rescuing boat would lift the buoy aboard and open telephonic communication by means of the telephone, *T*, in the central drawing, and, if necessary, would force down compressed air through the hose. Having anchored at a suitable point immediately above the injured submarine, the relief boat would loosen her own lifting pendants and drop them down through the salvage wells and draw the pads on deck over the side. The forward and after messenger lines would then be secured to the shackles, with the pads removed and pulled up through the salvage wells and properly attached to buoys, *D*, *D*.

Suppose the sunken submarine is 250 feet down, her deck 15 feet above the bottom, and her lifting pendants capable of reaching upward thus to within 110 feet of the surface. These pendants would be held vertically taut by the messenger lines. A diver could easily descend on a suitably constructed, weighted boatswain's chair 110 feet, and there join the pendants of the foundered vessel with those of the salvage submarine at the points *C*, *C*. Then, the rescuing boat would take in water ballast until she was just awash, and her cable clamps, operated from within the submarine, would grip the lifting pendants. By blowing out this water ballast and rising to the surface she would know that the injured boat was lifted free of the bottom. Finding that the damaged craft could thus be raised, the relief submarine would give herself negative buoyancy of a few pounds and sink gently down on the guiding lifting pendants until she was 100 feet below the surface. Again, gripping the pendants by means of the cable clamps and once more expelling her water ballast, the salvage boat would rise to the surface and lift to that extent the damaged submarine lying beneath her. The rescuing submarine, under her own power, could carry her load to shallower water, where she would repeat the first operation and gradually get her injured sister into moderate depths, permitting the escape of her imprisoned crew through the medium of the usual facilities provided for the purpose, possibly the wounded submarine then, by means of compressed air, could be raised to the surface.

To this latter end, the air line is extended to embrace every separate compartment with individual valves in each one of these spaces. By a suitable arrangement, when more moderate depths are reached, this air could be set free so as to drive out any invading water to the level of the upper edge of the injury admitting it. Before this, however, the relief air would be designed to sustain life only and would not be of a pressure corresponding to the hydrostatic pressure without. Should the messenger lines not be long enough to permit the marker buoy to reach the surface, still that buoy could be swept for carefully just as mines lying below the surface are now detected. Once found, the messenger lines could be secured to others lowered for the purpose. By following the latter down, provided the depth was not too great, a diver could reach the lifting pendants of the injured boat and join with them suitable salvage cables. The main point is that submarines to-day generally practice in groups just as they would be expected to operate in time of war, so that vessels of this sort provided with the installation here described would, without delay, be able to help one another if anything went wrong. The prime necessity is immediate assistance, for otherwise life might be sacrificed.

It was long ago realized by foreign nations that, notwithstanding the rapid and remarkable improvement that was constantly being made in the construction of submarines, accidents of just the kind that has happened to our "F-4" were certain to occur, and they began to make provision against these emergencies. One of our illustrations shows the "Vulkan," the specially designed vessel that was built by Germany a number of years ago, and which has demonstrated its value and utility in actual salvage operations. France soon followed Germany's example and built a still more powerful ship that is capable of lifting 1,000 tons from a considerable depth, while England and Italy made plans in the same direction. The vessels built by France and Germany have double hulls, after the catamaran style, so that the salvaged craft can be pulled up between them by means of strong tackles lowered directly downward, and operated by powerful winches carried on the framework that joins the two hulls. Both of these vessels are self-propelled, but the German boat has a tunnel that extends its whole length, while in the French design the twin hulls merge into a single bow, making a more seaworthy construction. In one of the German submarine accidents twenty-seven of the crew were passed out through the torpedo tubes, and rising to the surface were rescued. No incident of the kind is noted in the Honolulu disaster.



A, salving submarine; *A'*, lifting position; *B*, sunken submarine; *C C*, lifting pendants connected; *D D*, wrecking buoys; *E*, air hose; *F*, marker buoy on salving submarine. CENTRAL DRAWING—*T*, telephone connection; *L*, electric signal light. Lifting pendants lying on deck, but attached to messenger lines by the Dannenhower-Wotherspoon method.

Salving submarines.

Precautions Against Plague at Hongkong, according to a report from the American Consul-General at that place, represent a heavy item of expense in the trade of the port, which is ultimately borne by the American or other foreign consumer. All goods likely to carry the disease are disinfected before being offered for shipment, and all vessels carrying them are disinfected at least once every six months. An especially difficult problem is the disinfection and control of the lighters which are necessary for loading goods in the harbor. The number of plague cases registered in Hongkong last year was 2,148, but as 2,024 deaths from this disease were reported, the number of cases was doubtless much larger than the number registered.

As the orchestra played, lights of changing hue illumined the screen.

Color Music—A New Art Created With the Aid of Science

The Color Organ Used in Scriabine's Symphony "Prometheus"

By Harry Chapin Plummer

NEW YORK concert-goers, on Saturday evening, March 20, witnessed a novel departure from the conventional symphonic programme when the Russian Symphony Orchestra presented the tone-poem "Prometheus," of the Russian composer Alexander Scriabine, with the employment for the first time, as an "orchestral unit," of an instrument for producing colors, designated by the composer the "tastiera per luce" or "clavier lumière" (color-light keyboard).

The colors appeared, simultaneously with the rendition of the music, filtering through a mesh of fine gauze within a square framework at the back of the stage, above the orchestra, and were controlled from a keyboard, not unlike that of an ordinary piano. The player, or operator, sat at the keyboard in the body of the orchestra and, of course, facing the conductor. He was so located that he saw both conductor and screens. He followed the conductor's beat and the "music," which in appearance differed little from that of the "orchestral voices." As in the conductor's score, which had the part for the "tastiera per luce" at the top of the page in the position usually accorded the part for the first violins, the "music" for the color-light keyboard expressed the color requirements not in color terms, as "red" or "blue" or "green," but in musical notations, as "C," "F-sharp," "A," etc.

An arbitrary color-scale was employed by the composer of "Prometheus," corresponding with a musical scale upon which the tone-poem was built and which is equally arbitrary in the "new" tonal standards which it imposes. His tone-scale, with its color equivalents, follows:

C	Red
D	Yellow
E	Pearly Blue
F-sharp	Blue
A	Green
B-flat	Steely Gray

Harmonic combinations of these tones naturally demanded corresponding combinations of the various hues in the mesh upon which the gaze of the audience was centered, and, so, many variations of the primary hues and many tints were effected. With the drift of the music, the colors changed and dissolved by superposition, by juxtaposition and otherwise.

It is here that the peculiar nature of the composition which was the medium for the experiment should be pointed out. "Prometheus" is styled by Scriabine the embodiment of the creative energy of the universe—the creative principle of light, heat, life, energy, conflict, and physical and mental activity. Musically, it is what is known as a "programmatic" work, in that it affects to suggest more or less definite subject matter. It belongs in the category of what a sister art would term "futurist" music, principally because of the arbitrary tonal scale established and the striving of the author after a sequence of dissonance and cacophony, rather than the more absolute harmonies of earlier and "orthodox" composers.

In marked contrast to the complexity of the tonal scheme, the color scheme, as finally evolved, proved to be somewhat simple in its operation and in its results. The disadvantage of a fixed location for the colors was quickly discerned, as the illusionary and mystic effect so much to be desired in such a case was lacking.

The splendid resources of the Electrical Testing Laboratories of New York were placed at the disposal of Jacob Altschuler, conductor of the Russian Symphony Orchestra, for the preparations for the music-and-light concert. Preston S. Millar, general manager and secretary of the Laboratories, and past president of the Illuminating Engineering Society, personally supervised the building and installation of the apparatus, and he was assisted in the planning and construction by W. F. Little and in the production of color filters by William McKay, and others of the Laboratories staff.

To operate the color apparatus the player presses a key and that makes contact in the direct-current circuit, which actuates a relay, closing the alternating current circuit on the lamp or lamps, which are connected. There is one relay for each hue of light called for by the composer; the number of lamps varies from one to six.

The light of tungsten lamps is so largely yellow that one lamp suffices to produce the yellow hue, but little of this light having to be suppressed. On the other hand, when deep red or violet light is desired, it is necessary to suppress a large part of the light, leaving so little of the desired hue that a number of these lamps is necessary to give the requisite intensity. The lamps range in size from 100-watt vacuum tungsten to 400-watt gas-filled tungsten, and all were specially made for this purpose in unusually small bulbs, and supplied by courtesy of the General Electric Company.

The required regulation of the lamps to vary the intensity of the hues is obtained by employing the reactance in the common circuit feeding all of the lamps. This is operated by pedals, just as intensity of sound is controlled in a pianoforte or organ, the reactance being mounted directly beneath the keyboard and directly connected with the pedals. Whereas, in a piano the hammer is brought into immediate contact with the string, in this instrument the hammer is replaced by a carbon contact; depression of the key brings this contact into abrupt connection with a corresponding fixed contact, closing the circuit and actuating the relay.

Each lamp is inclosed in an opaque concentrating reflector, which gathers a large part of the light and projects it upward and over the mouth of which are placed color filters. These consist usually of three or four glass plates. The first is of crystal glass and is separated by about three eighths inch from the others for ventilation purposes, it being obvious that a great amount of heat is generated and

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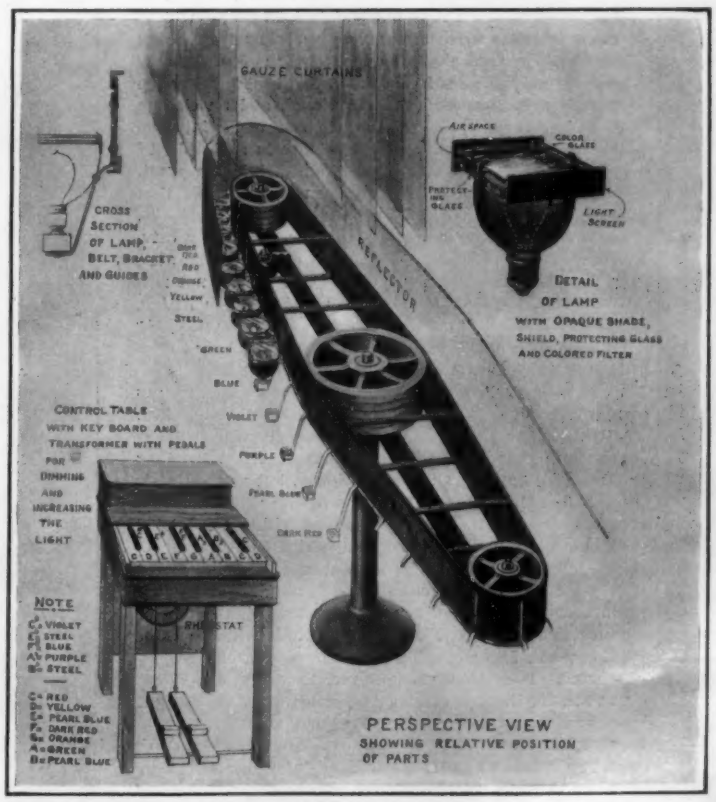
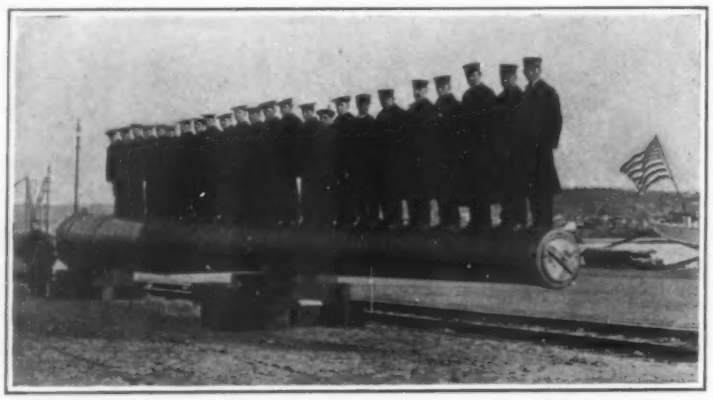


The mechanism of the color piano.

The 14-inch Guns of the United States Navy

THE accompanying photograph shows one of the 14-inch guns of the new dreadnought "Pennsylvania." In order to give some conception of the size of this gun, twenty-four members of the crew of the President's yacht "Mayflower" lined up on the gun to have their photographs taken with the big engine of destruction. This gun was built at the Washington Navy Yard. It has a total length of 54 feet, and weighs 63.3 tons. It throws a shell of 1,400 pounds weight to an extreme distance of 21,000 yards, in other words about twelve miles. This range could be increased materially did the ship mountings allow for a greater angle of elevation. To be sure the gun is entirely outclassed by the 15-inch guns of the British navy, which fire a projectile weighing 1,950 pounds with a muzzle velocity of 2,500 foot-seconds, as compared to 2,600 foot-seconds of our 14-inch guns. This gives the British gun, with its higher maximum elevation, an extreme range of about 24,000 yards. At the same time the 14-inch gun is not to be scorned. The powder charge it requires weighs 370 pounds, and at 10,000 yards its shell will penetrate 15.9 inches of Krupp armor.



One of the big guns of the new dreadnought "Pennsylvania."

Joy Riding in the Sky

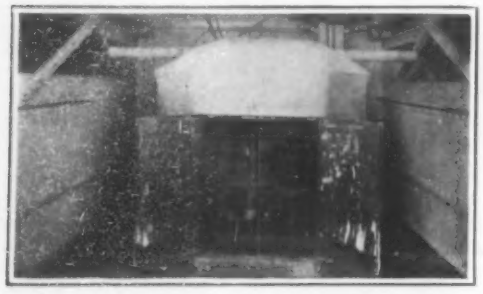
ONE of the prominent features of the "Zone," the amusement section of the Panama-Pacific Exposition, at San Francisco, is a device designed by a Chicago bridge builder which is called an aeroscope, and which will enable sensation seekers to experience some of the pleasures of an aeroplane ride with perfect safety. This contrivance consists really of a bascule bridge 250 feet long, which carries an inclosed passenger car at its free end. While the bridge arm is gradually raised, carrying with it the observation car, the entire apparatus is slowly rotated on a turntable, which results in a gentle spiral course being given to the car, simulating the gliding flight of an aeroplane and giving the passengers views in every direction over the surrounding country.

The entire structure is of steel, and the mechanism is operated by electric power, a heavy concrete platform forming the foundation for the device. On this foundation is a double circular track of railroad rails 61 feet in outside diameter. Eight four-wheel trucks on the rails carry the entire structure, which revolves about a vertical axis set in the center of the platform. Power for this purpose is furnished by four electric motors mounted on, and geared to alternate trucks. Upon the framework supported by the trucks stand two pyramidal towers that carry the trunnions upon which the elevating arm turns when lifting the observation car. This arm is about 215 feet long, while the overhanging counter-balance lever is about 30 feet long, and carries an immense block of concrete, weighing in the neighborhood of 600,000 pounds, which balances the lifting arm, car and its load of passengers so nicely that the only power necessary to raise the car is just sufficient to overcome the friction of the trunnions. Hence two electric motors of eleven horse-power each move the mass.

The observation car is a two-story structure, attached to the lifting arm by trunnions and links so designed as to keep the car vertical no matter in what position the lifting arm may be. The load for which the car is designed is 15,000 pounds, or one hundred people of an average weight of 150 pounds, but there is actually room to accommodate comfortably about 120 passengers, provided they do not exceed the prescribed weight. In order to ascertain this fact quickly and accurately, and also to enable a suitable adjustment of weight to be made when the full number of passengers is not carried, an ingenious construction has been devised. Two ballast tanks are hung below the floor of the car, and when it is in its depressed position these tanks dip into a reservoir of water below the loading platform, and the depth to which they sink constantly weighs and indicates the load. If this load is below the normal an automatic switch is closed, and an electric motor operates a rotary pump to run water into the ballast tanks until the proper balance is attained. If on the other hand the weight indicated is too great, another automatic device opens an escape valve that lets the required weight of water run out of the tanks.

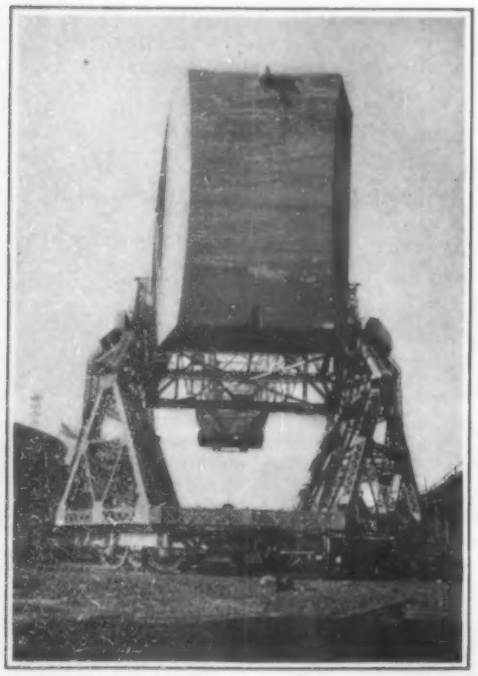
To carry out the idea of flying two electrically driven aeroplane propellers are located on the lifting arm, just under the observation car; but these do not furnish enough power to be of any assistance in lifting, and their effect is purely psychological. They probably mislead the passengers in a harmless way, and as an advertising feature serve to attract attention.

It is impossible to start the lifting or turning motors until the doors have been properly closed and locked. Then the cut-outs are closed, and the operating switches put into connection with the current. First the long arm carrying the car rises vertically, but as soon as it is high enough so that the car will clear the surrounding structures, the motors connected with the turntable trucks start, and the structure begins to revolve. As the arm rises it also swings around. In its ascent the car describes a great spiral. It requires about four minutes to lift the car to its extreme height, and the turntable makes one complete revolution in the same time; and in descending the same operations are repeated. It is possible, however, to vary these movements, for the arm can be stopped before it has reached a vertical position, and then swung around either in complete circles or back and forth through a portion of a revolution, while the passengers enjoy the panoramic view through the plate glass windows which entirely inclose the car.



The passenger car on the aeroscope is provided with two water ballast tanks which provide an even balance for the lifting arm on each trip.

The weight scheduled to be carried in the car is 15,000 pounds and the filling device adds enough weight in water each trip to make up the scheduled weight. If there is too much ballast, automatic emptying valves permit water to escape to the required amount. The pumping device is shown here filling the tanks.



A view of the towers which support the lifting arm of the aeroscope.

They are built in two portions to permit the counterbalance weight to swing between as the upper portion of the lighting arm assumes a vertical position. The towers are 49 feet tall and each merges at the top in a trunnion bearing on which the lifting arm pivots.

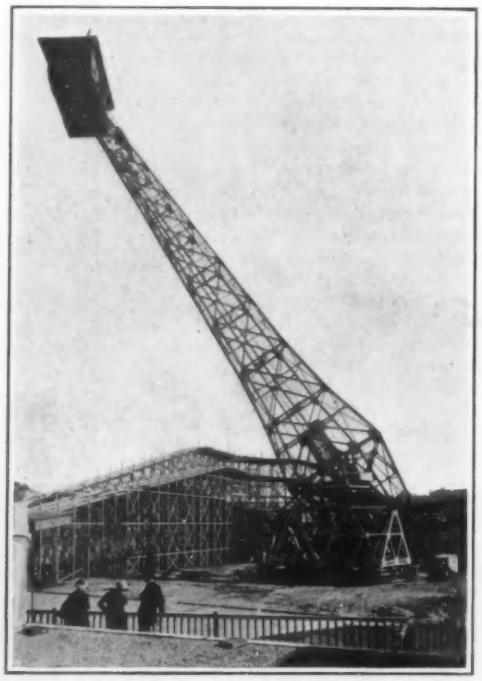
Effect of Tarred Roads upon Trees

A PARIS engineer, M. Hickel, gave the following report about the effects of tarring of roads upon trees and shrubs which border the roads. Dust which comes from the wear of the road, when it falls continually upon the leaves of plants, is often seen to cause lesions and burned places, starting from a simple spot and extending farther, even to a perforation of the leaf, according to Griffon and Mirande's observations. Vapors produced at the time of putting on the tar on the road have also a bad effect, though it is less. Damage is seen to depend also on the amount of traffic on the road and, too, upon the sunlight, and this latter favors the production of lesions. Ornamental plants, such as the begonia, are found to suffer much from the tar dust in these cases. Besides the lesions seen in leaves of trees, such leaves do not grow to full size, but are dwarfed, and in general the tree tends to perish. Different varieties of trees suffer less than others, for instance the sycamore is noticed to suffer less damage. Perishing of trees occurs only after several years. Tarring of roads is usually done because of automobile traffic, and the author recommends the following precautions so as to conciliate the two opposing interests:

Instead of a surface tarring, it is preferable to relay the road with the use of tar combined with the road material, so as to avoid frequent tarring operation and formation of dust. Where plants are found to suffer greatly from the effects of tar, another material should be used instead, and tests are now being carried on which give promise of finding what is needed in the class of bituminous and asphaltic substances. A radical solution would be the use of concrete roads.

Looking out from the passenger car of the aeroscope at a height of 250 feet above ground.

The capacity of the car is 120 passengers. Plate glass windows are used on all sides so as to give an uninterrupted view. It is possible to look out over the Exposition, the bay and a large portion of San Francisco as the structure is revolved.



The lifting arm of the aeroscope is here at an angle of about 75 degrees.

The car is lifted vertically from the landing station until clear of the surrounding structures, then the structure is revolved in a circle. Aeroplane propellers placed on the arm just below the car give an impression of flying.

Two Groups in the American Museum of Natural History

Wonderfully Realistic Reproductions of Animal Life in Natural Surroundings

By Joseph William Griggs

EVERY resource of science and art is employed at the American Museum of Natural History to reproduce nature faithfully. The stiff, unnatural display of other years has given way to the effective "group" form of exhibition. Of the many groups completed in recent months, two stand out conspicuously—the Wharf Pile Group and the Orizaba Group.

As a reproduction of nature and as an artistic piece of work, the Wharf Pile Group has never been surpassed. It was constructed under the supervision of Roy W. Miner. The handling of color and illumination has been so skillfully done as to produce distance in the scene above water and depth below. The group is based on actual observations by Mr. Miner and his assistants at Woods Holl, Mass., and shows the animal life of the abandoned wharf piles.

A field model had to be made in the nature of a sketch. Living specimens of the creatures of the wharf piles had to be taken to the laboratory and kept alive in sea water. Studies were made of them with and without the microscope; dozens of sketches and photographs were made.

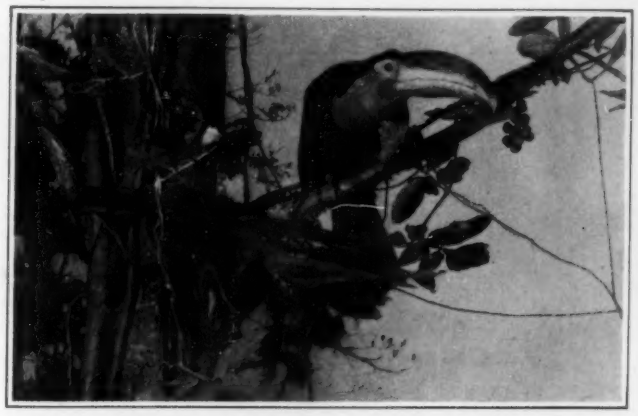
Hundreds of tentacles of the sea anemones, cirri for the serpuloid, and even some of the seaweed, are the work of the glass blower. The finest work in this line are the jellyfish and the squid. The former is considered a masterpiece of the glass blowers' art, while the peculiar translucency of the squid's body could be attained by no other medium. The coloring of these two models was done by a Japanese artist.

Much of the animal life was modeled in wax and celluloid. The accurate reproduction of the wharf piles was the work of Mr. Ignaz Matausch, who also assembled and anchored the hundreds of separate models and specimens in their final positions.

The coloring of transparencies proved a difficult problem, involving the application of transparent oil colors, selected for permanency under strong sunlight, to the surface of glass covered with delicate photographic film (in the case of the transparencies represented above the water line), and to the smooth surface of the plate glass for the submarine background. Five successive sheets of glass make up the submarine background, each colored in such a way that the daylight passing through the entire series gives the effect seen when looking horizontally through the waters of the ocean. Actual observation in the sea itself, with the help of a water glass and a submerged mirror, was the basis of the color scheme. Fishes, squid and a distant pile were painted on the successive plates of glass, giving them the lifelike effect of appearing suddenly from the gloom of the green sea depths. The illumination of the group is accomplished by placing it in front of a window.

The Orizaba Group called for a vast amount of work. To one artist was intrusted the painting of Mount Orizaba and a forest in the distance. Birds had to be placed in realistic trees in the foreground by others. As a basis for the whole group actual sketches had to be made in the Mount Orizaba region. This group shows a section of country which is three miles high, and according to Frank M. Chapman, of the museum, to find on a level the changes to be met with here a person would have to journey from Vera Cruz to Maine, a distance of 3,000 miles.

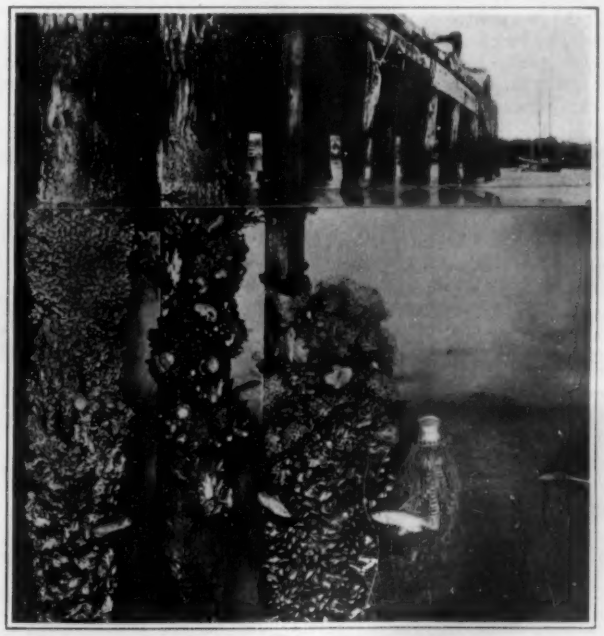
The observer sees, apparently, through the upper side of a gorge through which runs the Rio Blanca, the vine-hung tropical forest, the snow-capped Orizaba rearing its head 18,000 feet into the heavens. The foreground shows such birds as the motmots, trogons, parrots, tanagers, and big-beaked toucans. Even humming birds are hovering over orchids.



A toucan at home; a detail of the Orizaba group in the Museum of Natural History.

A section of the Orizaba group in the American Museum of Natural History.

Detail of the wharf-pile group, representing life under water.



Animals of the wharf piles—a remarkable model in the American Museum of Natural History.

Henry A. Ferguson and Louis Agassiz Fuertes made sketches around Orizaba for the group, and Bruce Horsfall, the painter, executed the background from these sketches. Transparencies at the sides of the group show scenes from different altitudes in the country portrayed in the painted background, from the tropical forest to the cold summit of Mount Orizaba.

Sounding Operations in the Rhone

IN order to find the depth of alluvion in the Rhone bed at the time of establishing the report upon the proposed barrage near the Swiss frontier, a novel method of sounding was employed. The present barrage is to be built across a narrow and deep portion of the stream, and is intended for the great Rhone-Paris hydro-electric plant. Having installed a pair of pontoons in the river, Engineer M. Lugeon found that the usual method of sounding by the use of boring tubes could not avail here on account of the nature of the current and other conditions, so that this led him to carry out the sounding by the use of rails, and to drive them down through the alluvion to the solid rock. On the pontoons he mounted a pile-driver having about 12 feet drop. The first rail was carefully pointed at the end, and it was driven into the soil by the pile-driver. When down to the water level, a second rail was attached to the end of the first by a special fish-plate, somewhat as for railroad practice; then the second rail was driven down by pounding until they no longer sank. The number of strokes at each point of sounding varied from 1,000 to 4,604, according to the nature of the soil. For the whole of the upstream profile, there were given no less than 18,046 strokes. When the rails went up farther, they were broken off flush with the river bed. Cutting off by dynamite could not be done here, as the explosive had no effect at 12 to 15 feet, so that the rail was broken off flush by repeated bendings. Noting the length of rail sunk in the soil, this gave the thickness of alluvion at each of the several points, so as to obtain the profile of the river.

Deflecting Rays Downward

THE trouble with glaring headlights on automobiles, which has resulted in many accidents and has been legislated against in some of the States of the Union, is demanding full attention on the part of motorists. There are a number of devices on the market at present which are constructed in a way to diffuse the direct glare of the lights, but there still remains plenty of opportunity for the inventor along these lines. One of the most promising of these devices has just been brought out by a Toledo firm.

The deflector consists of a small metal bowl highly polished on the inside. This bowl is attached to the electric bulb of the headlight and throws all the light rays directly upward into the upper half of the lamp reflector. The stream of light is thereby thrown directly forward on the road, the highest rays not reaching more than four feet above the ground. None of the light rays thus projected reach the eyes of pedestrians or approaching motorists.

The invention, of course, at once suggests the blackening or frosting of the lower half of the headlight reflector, which would give the same effect.

The Scientific American's New Home

THE first home of the SCIENTIFIC AMERICAN was at No. 11 Spruce Street, in New York city, where it was established in 1845 and published by Rufus Porter, a somewhat erratic genius who filled its columns with many other matters than those its title suggested. On October 20th, 1845, the office was destroyed by fire, and publication was suspended for two issues. When the publication was purchased by the new firm of Munn & Co., composed of Orson D. Munn and Alfred E. Beach, in July, 1846, the office was moved to the old *Sun* building, which then stood at the southwest corner of Fulton and Nassau streets. There the paper prospered for a number of years until the old quarters were found too small, particularly for the patent soliciting department which had been established. New and commodious offices were, therefore, secured in the original New York World Building at No. 37 Park Row, at the corner of Beekman Street, to which location the publication was moved in 1859, and this was its home until January 31st, 1882, when the building was completely destroyed by fire. Practically all the valuable records and papers that had been accumulating for years were lost.

The period from 1850 to 1882 had been one of unusual prosperity for the SCIENTIFIC AMERICAN. It had gained readers in every part of the country and in foreign lands, and had won for itself a reputation as an authority on technical matters. No time was lost in securing temporary quarters, and publication was continued without a break from No. 261 Broadway, at the corner of Warren Street. Here the offices were maintained until 1884. In that year the establishment moved to No. 361 Broadway, at the corner of Franklin Street, where two commodious floors have been occupied until now.

After thirty years at No. 361 Broadway, it was felt that more modern quarters were needed—quarters that harmonize with the character of the SCIENTIFIC AMERICAN and the patent soliciting of Munn & Co. The Woolworth Building, the tallest and most modern structure of its kind in the world, was selected as the new home of the SCIENTIFIC AMERICAN and of Munn & Co. Two wings of a whole floor will now house the staff of the SCIENTIFIC AMERICAN and the Patent Department of Munn & Co. The new home of the SCIENTIFIC AMERICAN and Munn & Co. is not only more commodious than the old, but is so well equipped with conveniences of all kinds that the businesses of publishing an important periodical and soliciting patents can be conducted with even greater efficiency than before.

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The new home of the Scientific American—the Woolworth Building.

The "Torpedo" Motorcar

THE remarkably shaped motorcar shown in the accompanying illustration has been built in Italy, it is reported, according to designs evolved by Count Marco Ricotti of Milan. It carries, as will readily be understood, the matter of streamline body design further toward its logical conclusion, although it stops short of the real goal. In this connection it may be interesting to point out here that as long ago as January, 1913, the SCIENTIFIC AMERICAN pictured the "automobile of the future" as a fully inclosed torpedo, in which even the wheels and mudguards disappeared within the "streamline" curve.

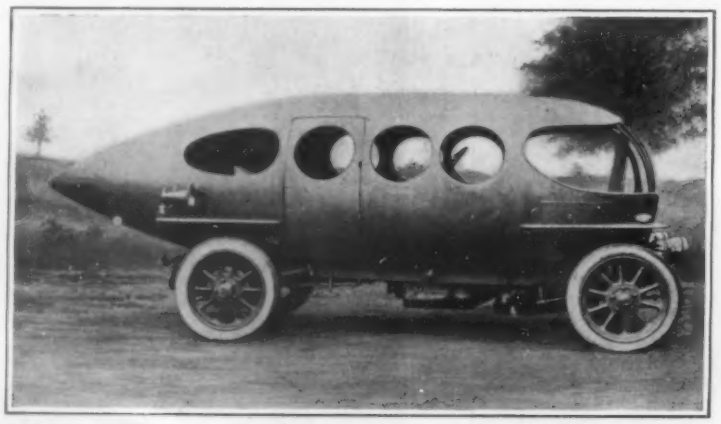
The Ricotti car is fitted with a 50 horsepower four-cylinder motor, which enables this torpedo on wheels to cover ground at the high rate of 80 miles an hour. Removing the streamline body and letting the car go at top speed in "stripped" shape, immediately reduced its speed to 65 miles an hour.

When one considers the considerable weight which such a body has, it must be regarded as a remarkable demonstration of the importance of wind resistance at high speeds. The ordinary touring car, with a maximum speed of some forty-five miles an hour, would probably show an increase of five miles or more, per hour, if a real torpedo body were mounted on its chassis.

Aside from the higher speeds attained, the chief value of a body such as Count Ricotti has chosen lies naturally in the protection from dust and rain. The front of the car can be closed by means of a curved windshield of glass.

In order not to catch the air too forcibly with curved mudguards, the Ricotti car is fitted with mere horizontal strips of sheet iron placed six inches above the tires.

The curiously shaped windows suggest a submarine boat. As a vehicle of distinction, the Ricotti car probably would create a good deal of attention should it run along Broadway, New York, on some bright summer's day, but that the general public would not care to hide behind the narrow windows is hardly to be doubted—for one of the most powerful factors in the evolution of a motorist is the desire to "see and be seen."



A motorcar that looks like a submarine on wheels.

A Lightweight Electric Vehicle

HITHERTO the electric pleasure vehicle has not been a serious competitor of the gasoline car, but has filled a special field of its own. For despite its cheapness of operation, simplicity of control, ruggedness and cleanliness, it has labored under the handicap of a big storage battery that makes the car heavy and expensive, giving only a limited speed and radius.

But a new electric car has just been announced which boldly aims to invade the field of the low priced gasoline car. This it expects to do by a radical simplification of mechanism that will cut down weight, making it possible to use a far lighter battery, and thus reducing the handicap materially. In this new car the differential gearing on the driving axle will be dispensed with and the driving motor will take its place. The differential, as all of our readers probably know, is the gearing which permits one of the driving wheels to travel faster than the other when the car is making a turn. In the ordinary motor the field remains stationary while the armature revolves, or the armature remains stationary while the field revolves. But in this motor both elements will revolve in opposite directions, one element being connected to one half of the driving axle and the other element to the other half. Thus, the power is divided between the two halves of the axle, so that in taking a turn one may readily move faster than the other exactly in proportion to its load. Of course, if the axles were directly connected to the armature and fields, respectively, the two driving wheels would revolve in opposite directions. But a very simple gearing has been introduced, based on a new mechanical movement, comprising one stationary gear, one rotating gear, and a "floating axle." By this means a gear reduction of 6½ to 1 is introduced between the motor and the driving axle, and the motion of one half is reversed with respect to the other half, so that both of the driving wheels turn in the same direction. The entire rear axle with its motor of 2 horse-power weighs under 100 pounds, which is even less than the weight of the common rear axle with its differential.

Of course, it will be understood that, owing to the uniform torque of the electric motor, a much lower power is required than if a gasoline engine were used. One of these rear axles with 2 horse-power motor was installed on a car weighing 1,810 pounds and proved sufficient to drive it at a rate of over twenty miles an hour. But a new car is being built which will have a total weight of only 1,200 pounds, 600 pounds of which will represent the lead battery. With this, no doubt a higher speed will be obtained. Were Edison batteries used they would weigh but 450 pounds. It is planned to reduce the weight of the vehicle even further, making it only 1,000 pounds, in which case it would have a battery of only 500 pounds, the plan being always to let the battery represent half of the total weight of the car. This is a higher proportion than now prevails, for the common practice at present is to let the batteries represent only about 40 per cent of the total weight of the car.

As the car is reduced in weight, its cost is reduced in even greater ratio, and it is fully expected that this car can be manufactured and sold at a price that will compete with low-priced gasoline vehicles. Of course, it will still be handicapped in the matter of high speed and radius of travel, as well as by a scarcity of recharging facilities outside of the big cities, but it is believed that these disadvantages will be far outweighed by its advantages. Any material increase in the use of electric vehicles will naturally be followed by an increase in charging facilities.

As there is no mechanism connected with the motor except that contained in the housing of the rear axle, all the rest of the space ordinarily occupied by motor and gearings can now be used for storage batteries. The motor itself can be run at double the speed of present motors of the same horse-power, because the speed is divided between the two parts of the driving axle. It is designed to run interchangeably as a shunt or a series motor by the mere pressure of a push button. On hills it may be made to act as a brake, and when certain speeds are exceeded it will act as a generator to put back current into the battery, thus greatly economizing the power stored in the battery. Unfortunately, at the present time, we are not permitted to give complete details of the machine, owing to the condition of the patents, but we expect at a later date to take up this subject again and explain more fully this interesting development in the electric vehicle. We can merely hint now that this differential motor might be used on gasoline-driven vehicles. A light gasoline motor running at constant speed and direct connected to a generator would furnish power to the differential motor on the rear axle. This, without adding much, if any, weight to the machine, would provide a very simple control of the vehicle and do away with all the complications of gearing now required. The inventor of this electric vehicle is Mr. Harry E. Dey, who has as his associate in the development of the vehicle, Dr. Charles P. Steinmetz, the electrical engineer of wide renown.

"An Exhaustive Monograph on the Turquoise," by Joseph E. Pogue, has just been published as the third memoir of volume 12, in the *Memoirs* of the National Academy of Sciences. Although thoroughly scientific in character, this treatise appeals to everybody who is interested, in the lore of precious stones, as the historical, mythological, and archæological aspects of the subject are fully treated, in addition to the mineralogical, geological, and technological. The memoir includes a large annotated bibliography.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

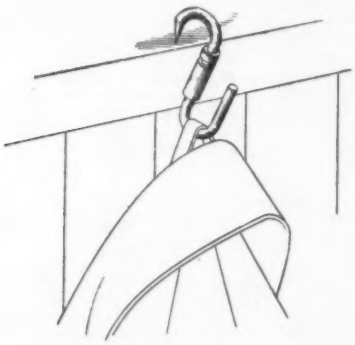
Pertaining to Apparel.

HOSE SUPPORTER.—E. SCUDDER and C. M. CORLEW, 3-4 Southwestern Bldg., Sioux Falls, S. D. This invention is an improvement in hose supporters, and has for its object to provide a supporter arranged to connect the hose to the undergarments without encircling the leg to cause injurious pressure, which may

HOSE SUPPORTER.

be easily detached and detached without any danger of tearing or otherwise injuring the clothing. To release the supporter it is necessary to remove one of the folds from between the gripping jaws and the support may be left in place on either the sock or the underwear.

COAT HOOK.—J. T. WHITE, 61 W. 133rd St., New York, N. Y. The object of the invention is to provide a portable coat hook adapted to be readily extended and attached to a suitable support for supporting a coat or



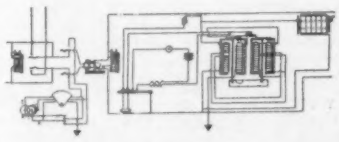
COAT HOOK.

other garment and adapted to be folded into a safety position, to take up very little room with a view to allow of conveniently carrying the coat hook in a pocket.

Electrical Devices.

TELEGRAPH REPEATER.—F. E. WALLACE, Heddie, Cal. This invention improves and simplifies the construction and operation of telegraph repeaters so as to be more reliable and efficient in use, less expensive to manufacture, install and keep in repair, and so designed that a more rapid transmission of messages is possible without distortion of the dots and dashes, and rendering it possible to repeat through an indefinite number of circuits with practically as good results at the final as at the initial circuit.

TELEPHONE SYSTEM.—H. M. WRIGHT, Cashion, Okla. Mr. Wright's invention has reference to party line telephone systems in which the central station is provided with a selective switch for calling subscribers and for locking out such subscribers as are not called. The



TELEPHONE SYSTEM.

accompanying diagram shows a central station, and the nearest one of the subscribers' stations, this being a part of a lockout system in which the subscribers' stations are not provided with hand controlled selective switches.

SOUND REPRODUCER AND RECORDER.—W. J. TRAVERS, 420 Parkside Ave., Buffalo, N. Y. In this case the invention relates to sound reproducers and records and has reference more particularly to the stylus bar and its armature, in which magnetic means are used for maintaining the stylus bar armature in a predetermined position.

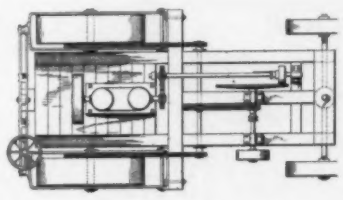
Pertaining to Aviation.

AUTOMATIC STABILIZING AEROPLANE.—W. HUEBNER and O. KUNKEL, 22 Main St., Garfield, N. J. The operating part constituting the propelling and balancing mechanism, as well as the basket, are supported in a manner to permit the supporting planes to turn at various angles under the influence of air currents, while at the same time increasing the buoyant action of the planes, whereas the basket and working parts referred to will remain normally dependent, and the liability of the operator losing control of the machine or being thrown from his position, will be obviated.

Of Interest to Farmers.

INSECT DESTROYER.—M. D. BAREFIELD, Hollandale, Miss. In this device a wheel supported frame is provided, upon which is mounted a fan having delivery pipes, spaced apart and laterally and longitudinally of the frame and adapted to move on opposite sides of the row of plants to blow the insects and the like into the furrows at each side of the row and having in addition mechanism for burning the insects after having been blown into the rows, and having other mechanism for spraying the plants with an insecticide.

TRACTOR.—C. W. LOEFFLER, Cedar, Mich. In this instance the invention has reference to tractors, the more particular purpose being to provide a tractor with running gear so arranged that the body or platform of the trac-

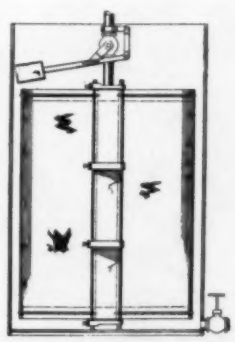


TRACTOR.

tor may be maintained substantially level, while the wheels engage the ground at different levels. The tractor admits of general use, but is of special service in connection with plowing the land.

Of General Interest.

FILTER.—C. A. YOUNGMAN, 1217 2nd St., Louisville, Ky. This invention relates to the filtration of liquids, particularly to the filtering and clarifying of whiskies, wines, beers, etc., and one of the main objects thereof is to pro-



FILTER.

vide a relatively enormous area of the filtration medium within a relatively small compass. A further object is to provide a rack for supporting the said medium, which permits of ready and easy installation and removal of the medium.

FOLDING BOX.—S. BERGSTEIN, care of Interstate Folding Box Co., Middletown, Ohio. The invention has reference to folding boxes, and the main object thereof is to provide self-contained means for maintaining the members thereof in position when set up for packing articles therein, such as clothing and the like.

PICTURE FRAME.—M. LOEWENTHAL, 1133 Broadway, New York, N. Y. The invention relates more particularly to such frames as are adapted for framing pictorial novelties, such as post-cards, photographs, and fancy prints. It provides a structure which may be bent or shaped to the desired form, said structure being constructed as an elongated article, arranged so that a number may be nested for transportation or storage.

AX DISPLAY STAND.—C. L. SAMUEL, Pryor, Okla. The objects here are to improve and simplify the construction of exhibiting stands, racks or the like, so as to be comparatively inexpensive to manufacture, to take up a minimum of floor space while having a large storing capacity, and at the same time holding the axes in such a manner as to effectively display them.

DISPLAY AND VENDING APPARATUS FOR SPECTACLES.—D. D. SULLIVAN, Fargo, N. D. This apparatus is for use in stores for displaying, selecting and vending spectacles, eyeglasses and similar instruments of vision, and arranged to enable a customer who is without knowledge of optics to readily select the proper instrument of vision. It is for use of opticians for quickly and accurately fitting persons for proper spectacles or eyeglasses.

SAMPLE CARD.—C. GREEN, 78-80 Walker St., New York, N. Y. This invention has reference to improvements in sample display cards, and has for an object to provide a structure wherein the card is properly held in place and a display tag is provided with a number or other identifying designation arranged thereon.

NAPKIN.—E. A. DE ROSE, 51 E. 42nd St., New York, N. Y. This invention refers to napkins for use by women, more especially where such are formed into catamenial sacks, and it provides such devices which are sanitary, odorless in use, readily placed in position and removed, easily cleansed, and which also protect the person and garments of the wearer.

LANTERN SLIDE.—F. A. APFELBAUM, 1560 Broadway, New York, N. Y. This invention provides slides with manually adjusted means for showing the time on the illuminated field of the screen used for exhibiting said slides; provides a means for adjusting the hands used in conjunction with a clock dial for announcing the time periods; and performs the operation of mounting said hands for use in conjunction with the dial in a manner to avoid destruction or damage to the dial or element carrying same.

FIRE LEER.—J. J. DENNING, 3025 South Raymond Ave., Los Angeles, Cal. The improvement pertains to a portable leer or annealing oven for glassware, more particularly intended for tumblers, glass dishes, goblets, and the like. The construction and arrangement of the leer is particularly designed for effectively utilizing the heat of the molten glass for annealing.

Hardware and Tools.

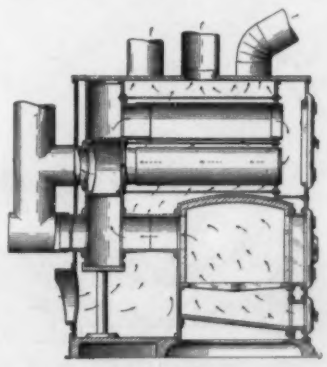
DRILL.—F. R. WEATHERSBY, 312 Scanlan Bldg., Houston, Tex. The invention relates more particularly to drills of the type suitable for earth boring, the more particular purpose being to provide a drill having means for positively centering the drill before the main cutting edges thereof come into play so that the drill will be at all times guided in an accurate straight path.

Heating and Lighting.

FIRE GRATE.—H. BENTON, 764 Newark Ave., Elizabeth, N. J. This improvement provides a structure adapted to facilitate the removal and renewal of destructible portions; provides for dumping certain portions of the fire-bed; provides for regulating the movement of the fire supporting members of the grate bar, and to provide for installing grates and bars therefor.

DOWNDRAFT SIDE FEED SMOKELESS FURNACE.—M. E. HERBERT, care of Herbert Boiler Co., Root and La Salle Sts., Chicago, Ill. This invention provides means in a side feed furnace for holding the coal at the sides until it is coked by means of water legs, and for then feeding the coked fuel to the center of a water tube grate and between the water legs, and having a lower grate provided for catching and holding the smaller particles, and wherein means is provided for moving the fuel, and also means for constraining the draft to pass down through the burning fuel to consume all of the carbon usually wasted as smoke.

FURNACE.—F. O. MOLL, 449 Baldwin St., Portland, Ore. This furnace is of the "warm-air" type and the object of the inventor is to produce a heater of this nature which will be easily cleaned, proof against leakage through its walls of the gases generated therein, and so



FURNACE.

constructed that the parts thereof can be replaced when any are worn out. It will readily radiate heat, require comparatively little fuel in operation, and be capable of using a lower grade of fuel than is usually required for similar furnaces now on the market.

Household Utilities.

FLY TRAP.—J. CRAWFORD, P. O. Box 137, El Paso, Tex. In this trap the flies will be readily attracted, and they will find free and ready entrance. The trap is so formed that the trapped flies may be conveniently and readily disposed of, and may be adapted for thorough and convenient cleaning in order to preserve its sanitary condition.

LAVATORY STRIKE.—O. KATZENBERGER, 215 N. Huron St., Chicago, Ill. This invention relates to what are known as strikes, and particularly to lavatory strikes, and has for an object to provide an improved structure which may be readily applied to marble slabs or other supports of various thicknesses without injuring the slab or support, or the strike.

COVER FOR WASHTUBS.—H. GREASON, 108 W. 99th St., New York, N. Y. The purpose of the invention is to provide a new and improved sheet metal cover for wash tubs and the like, which is exceedingly strong and durable and not liable to bend or warp or injure the tub, especially if the latter is made of soap stone or slate.

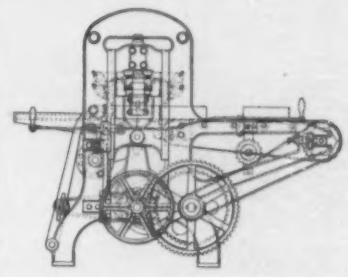
CLOSING DEVICE FOR DOORS.—C. W. STITES, 58 E. 86th St., New York, N. Y. This invention provides a device for closing the space between the hinge side of the door and the jamb whether the door is open or closed, thus preventing persons from peeping through the said space into the room, at the same time rendering the door air and dust proof at this point.

Machines and Mechanical Devices.

SAW SETTING, FILING, AND SWAGING MACHINE.—O. PAULSON, Box 6, Heber, Utah. This invention improves and simplifies the construction and operation of saw machines of this character so as to be reliable and efficient in use, easily and quickly adjusted and operated and capable of being mounted on the table of the saw machine in co-operative relation with the band saw while the latter is in position.

BREAD SLICING MACHINE.—M. KRONFELD, 67 E. 106th St., New York, N. Y. This invention provides a machine having a base and guard for holding a loaf of bread in substantially definite position, a series of knives and means for actuating of said knives simultaneously in parallel planes so as to reduce the entire loaf or any desired portion thereof in a single operation.

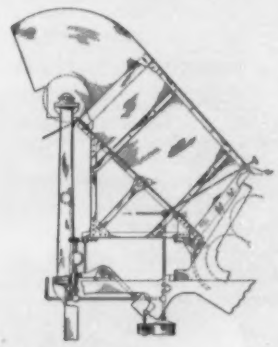
BRICK SURFACING MACHINE.—C. F. THOMAS, Buckeystown, Md. The primary object of this invention is to provide a device which will press a brick so as to leave the



BRICK SURFACING MACHINE.

surface in a perfectly smooth condition, and which will deliver the brick thus surfaced. A further object is to provide novel means for first applying pressure upon the sides of the brick, then upon the ends, and finally upon the top and bottom.

AUTOMATIC FEEDER FOR MILLS, CRUSHERS, SHREDDERS AND THE LIKE.—J. A. PIETSCH, 1383 Union St., Brooklyn, N. Y., N. Y. The object here is to provide an arrangement, whereby the power will be controlled as the material is being fed to the rollers. Also, to provide a counter-balancing device for the



AUTOMATIC FEEDER FOR MILLS, CRUSHERS, SHREDDERS, ETC.

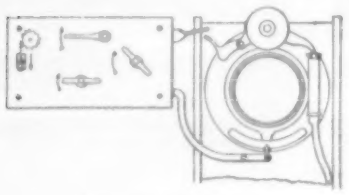
chute which acts for maintaining the power turned on until the chute has received a predetermined amount of material. Means provide that when the chute is in one position the power is permitted to operate the feeding carrier, and as the chute is moved to another position by the weight of the material in the chute the power is gradually turned off.

GRINDING MACHINE.—R. K. MCDOUGAL, 1542 O St., R. 2, Lincoln, Neb. The object in this case is to provide a machine especially adapted for grinding the cylinders of explosion engines, without the necessity of moving the cylinder, and wherein all of the cylinders of the multi-cylinder engine may be ground, without the necessity of clamping the cylinders, with the consequent distortion of the bore.

VIBRATING SCREENING AND SIZING DEVICE.—A. E. CUSTER, 703 9th Ave., Salt La

City, Utah. This inventor provides a device for economically treating ores in which the over-size is separated from the fine material, the latter being fed to an amalgamator, or device for final treatment of material in the form of a thickened pulp. He also provides a screen in a launder operated by the water which passes through the launder.

CAMERA ATTACHMENT.—W. E. MELHOLLAN, Juneau, Alaska. In this patent the invention has reference to photography by aid of a camera, and more particularly compre-



CAMERA ATTACHMENT.

hends an attachment for automatically operating the shutter of the camera at the expiration of a predetermined time limit, for which time limit the attachment is set beforehand, at the will of the operator.

AUTOMATIC HAND FIREARM.—A. FYRBERG, 96 Chambers St., Worcester, Mass. The breech block can be readily disconnected from the recoil spring device to allow of moving the breech lock rearwardly by hand with a view to permit the first cartridge in the magazine to pass to position for being pushed into the barrel on returning the breech block and whereby the complete withdrawal of the breech block and the firing pin carried thereby can be had for repairs or other purposes, and whereby the barrel can be quickly and securely fastened in position on the frame.

DISK HOLDER.—J. A. MAKER, Torrey Bldg., Duluth, Minn. This invention relates to disk holders of the type employed in connection with abrasive disks of small size, such for instance, as are used by dentists, the more particular purpose being to provide an efficient mounting for the disk while the latter is subjected to rapid rotation.

CRUSHER.—A. W. WARSEN, 1440 E. 15th St., Brooklyn, N. Y., N. Y. This improvement has reference to crushers of the jaw type; and the object thereof is to provide a simple, strong, and inexpensive crusher by means of which material can be crushed to varying sizes, not exceeding a predetermined maximum.

BROOM MACHINE.—F. W. REESE, Paris, Ill. The object here is to provide an easily operated machine for holding a broom handle during the formation of the broom, wherein a normally operative gripping device is held in inoperative position by a latch or other means, which is released by the insertion of the handle into the machine.

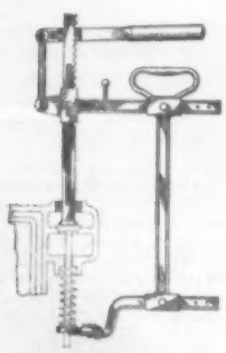
VALVE.—N. B. CREIGHTON, Chicago St., between Horton and Ivy Sts., Elmhurst, N. Y., N. Y. The object of the present invention is to provide a valve which is normally held in open position for the passage of gas, liquid or other fuel and is arranged to permit closing from a distant point and to close automatically in case of a fire with a view to stop the flow of fluid through the valve.

MULTIPLE SIGNATURE MACHINE.—W. F. WILLIAMS, Box 100, Miami, Ariz. In the present invention Mr. Williams provides improved forms of supporting bearings for the several relatively movable parts, whereby friction is practically eliminated, allowing free swinging and sliding movements as are required for a successful operation of the device.

TREE REMOVING MACHINE.—H. C. LEWIS, East Rockaway, L. I., N. Y. The invention has for its general objects to improve and simplify the construction and operation of tree transplanting machines whereby the operations of removing, transporting, and placing a large tree can be expeditiously, safely, and cheaply performed.

Prime Movers and Their Accessories.

VALVE LIFTER.—G. G. THAU, 1142 West Ave., Buffalo, N. Y. This inventor provides a device capable of the necessary adjustments to suit different sized motors and different sized



VALVE LIFTER FOR INTERNAL COMBUSTION ENGINES.

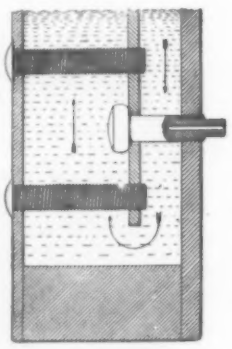
valves. He provides a lever for effecting the clamping or gripping of the valve, and provides on the frame of the device a handle so situated relatively to the lever, that one man alone using the device can so manipulate it as to remove or replace a valve from a dismantled cylinder without tipping over the latter.

ROTARY ENGINE.—E. N. BATY, 1325 Norton Ave., Des Moines, Iowa. Mr. Baty's invention has for its object the provision of a rotary engine having means for opening and closing valves in a cylinder as a piston rotates therein, steam being supplied to the cylinder through one end of the piston shaft and the piston and the steam being exhausted through a port in the other end of the piston shaft.

PRESSURE GENERATOR.—E. B. PORTER, 132 Main St., Penn Yan, N. Y. The invention provides a pressure medium to be used for power purposes; for example, as the motive agent in prime movers of almost any type; and it has for its primary object the generation of the required pressure in a manner that will avoid all waste and losses and make available for the purpose mentioned every particle of energy generated.

INTERNAL COMBUSTION ENGINE.—F. E. BAKER, Birmingham, England. This invention relates to internal combustion engines, such as are used for propelling motor cycles and other motor vehicles, and refers more particularly to the type of engine in which a change-speed gear is contained in the crank casing.

STAY BOLT.—D. J. O'BRIEN, Box 1002, Jerome, Ariz. The invention refers more particularly to the flexible type of stay bolt associated with a partition in the boiler for perfecting the circulation of the fluid to be heated.

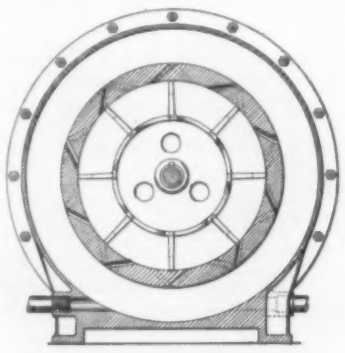


STAY BOLT.

It provides a stay bolt and partition of simple, strong, and durable construction, which bolt has means for readily indicating any injury thereto, and which will insure at all times a universal tensile strength.

CURRENT MOTOR.—C. C. COOKE, Allison St., Howard, Pa. This invention relates more particularly to a current motor, including an endless chain suitably mounted and carrying a series of feathering wings or blades whereby to form the water wheel, and a support in which the water wheel so constructed is disposed, and whereby each of the wings or blades on the lower run of the chain is subjected to the action of an independent fluid jet during the operation of the motor.

TURBINE.—L. W. GRAYSON, 109 Cleveland St., Youngstown, Ohio. The invention relates to turbines or rotary engines to be operated by any suitable fluid under pressure. It comprises a rotor formed of a central disk, having tubular sections projecting laterally from one



TURBINE.

side of the disk, and radial blades to each side of the disk above the sections, with openings in the disk establishing communication between the tubular sections and each side of the disk.

Railways and Their Accessories.

TRAIN PIPE.—J. M. DORAN, 250 21st St., Ogden, Utah. This invention is for use especially for conducting steam, water, gas or air throughout the cars of a train. While intended for use especially for connecting cars, the construction is such as to enable it to be adapted for forming a pipe connection between bodies which have a vibration or relative motion with respect to each other.

TRACK GAGE.—R. A. HENINGTON, Section Foreman, Washington, Miss. The invention relates to means for indicating a variation in the width of a track; and it has reference more particularly to a device which may be provided on vehicles used for inspection of tracks. It provides a device which will indicate spreading in the track by giving an alarm at the places where the spreading has taken place.

TRAIN SIGNAL APPARATUS.—J. S. ALLEN, 115 Broadway, New York, N. Y. The improvement provides a train signal apparatus, in which the signal is thrown into danger position by mechanism operable by a weight when a train is on a certain section of the track, the weight being raised by a motor, when the train reaches the said section of the track, to throw the signal into safety position.

Pertaining to Recreation.

GOLF CLUB.—H. P. DIXON, Wallingford, Pa. This improvement provides a golf club arranged to provide the desired rigidity in a

GOLF CLUB.

portion of the stick or shaft adjacent the head with a view to cause the shaft to flex near its middle to enable the player to drive the ball accurately with full force in the desired direction and to prevent the head from becoming accidentally detached when using the club.

WATER WINGS.—C. HOLROYD, 3412 Bates Ave., Pittsburgh, Pa. This invention refers to inflated bags commonly known as water wings and used by persons who are unable to swim, and the main object thereof is to provide a means for connection with the bathing suit in order to prevent the wings from escaping from

WATER WINGS.

the bather, and to prevent the wings from slipping to one side of the body, both of these faults in the water wings as now provided tending to decrease the confidence of the bather, particularly when being taught to swim in deep water.

GAME APPARATUS.—I. F. STILL, 109 Main St., Ossining, N. Y. This invention provides an apparatus with which may be played a game which will not only interest the players, but which will instruct them as to geographic divisions and localities and the principal products which are produced in the said locali-

GAME APPARATUS.

ties. The engraving shows a plan view of the board which is used in playing the game and showing the positions of the cards representing commodities. Each card has the name of a State or locality, the name of a commodity which the card represents and the words indicating the best method of shipping the commodity and the cost of shipment.

Pertaining to Vehicles.

AUXILIARY ACTUATING DEVICE FOR THE BRAKE MECHANISM OF AN AUTOMOBILE.—E. A. DIETERICH, 910 Caldwell Ave., Bronx, N. Y., N. Y. In carrying out this invention use is made of a manually-controlled electrical mechanism connected with the regular brake mechanism of the automobile and having electrically-controlled operating means extending within reach of the occupant of the rear seat of the automobile. Mr. Dieterich has invented another device of the same title as the first, in which use is made of a manually-controlled mechanism connected with the regular brake mechanism of the automobile, and having operating means extending within reach of the occupant of a rear seat of the automobile.

FIRE PROTECTOR AND ANTISKID DEVICE.—W. S. RAWLINGS, Marshall, Ind. This invention employs transverse chain elements, together with means to secure said elements in position. The device is made in small sections, for use as a boot over an outside patch, or made to extend completely around a tire as an antiskid device and tire protector.

TIRE REST.—W. H. HOLTBY, Hobart, Okla. This invention provides a support for an automobile or like vehicle provided with rubber tires for holding the vehicle in elevated position with the tires out of contact with the supporting surface for the vehicle. Mechanism is provided for permitting the vehicle to be moved off and on to the support under its own power.

AUTOMOBILE HEATING DEVICE.—E. RUTTLE, care of Rosedale Green Houses, Licking and Michigan Aves., Covington, Ken. This invention provides a device by means of which an automobile may be heated by the waste products of combustion from the engine. It provides a heating device in which the pure fresh air is heated, thus dispensing with all obnoxious odors. It further provides a heating means which may be regulated so as to heat the vehicle or not as desired.

FUEL MIXING DEVICE FOR INTERNAL COMBUSTION ENGINES.—W. F. JENKINS and R. L. JENKINS, 400 Seminary Ave., Ginter Park, Richmond, Va. An object here is to provide a device which may be readily applied to the intake manifold of internal combustion engines of any standard make of automobile without necessitating any changes whatever in the number or shape of the parts of the apparatus to which the device is to be applied.

WAGON LOADING APPARATUS.—G. HAISS, 141st St. and Rider Ave., Bronx, N. Y., N. Y. The invention relates to apparatus for facilitating the loading of wagons with material, or for the transference of material in a pile to another point, and it has to deal more especially with a wagon-loading machine of that type which is itself a vehicle capable of being transported from place to place.

Designs.

DESIGN FOR A HANDLE.—F. S. DICKINSON, care of Becton, Dickinson & Co., Rutherford, N. J. In this ornamental design the handle is shown in perspective view; in a sectional side elevation of the palm rest of the handle and with the shank shown in elevation; and in a cross-section of the same with the shank shown in elevation.

DESIGN FOR A BOTTLE.—F. K. WOODWORTH, care of The C. B. Woodworth Sons & Co., Rochester, N. Y. In this ornamental design the bottle is shown in three views: a side elevation, an edge view, and a plan view.

DESIGN FOR AN ARTICLE OF MANUFACTURE.—LÁZARO DE LA GARZA, Torreon, Mexico. Address R. E. Navarro, care of Norris Peters Co., Washington, D. C. Mr. de la Garza has invented six new and original ornamental designs, designated in each case as a Design For An Article of Manufacture. The designs are numbered 47,028, 47,029, 47,030, 47,031, 47,032, 47,033, and are under date of March 2nd, 1915. All are in form very nearly that of U. S. treasury notes, and cover a wide range in character from the plain to the ornate.

DESIGN FOR A NECKTIE.—A. BENNETT, 123 Prince St., New York, N. Y. In this ornamental design for a necktie the article represents a very original and attractive formation.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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MARKETING INVENTIONS

IN CONNECTION with developments of its own laboratories the undersigned will consider any meritorious inventions ready for the market, especially those relating to motor car and mechanical lines. Address with copy of patent. McCormick Laboratories, McCormick Manufacturing Co., Dayton, Ohio.

NEW PUBLICATIONS

THE MECHANICS OF ELECTRICITY, $1.25. Electricity fundamentally explained. By F. J. B. Cordeiro. Spon & Chamberlain, 123 Liberty Street, New York.

FOR SALE

OWING TO REMOVAL OF OUR OFFICES, we desire to dispose of two safes, one about 1½ tons, depth 2 ft. 6 inches, width 3 ft. 5 inches, height 6 ft. —the other about 5 tons, depth 3 ft. 6 inches, width 5 ft., height 7 ft. Both safes in good condition. Munn & Co., 361 Broadway, New York.

PATENTS FOR SALE

WATER POWER DESIGN which reduces the cost of development and increases the output efficiency, especially during floods. Water Chronicle, 34 West Congress, Detroit, Mich.

U. S. PATENT No. 1,107,968, Aug. 18, 1914. Brake for Marine Vessels is for sale. For further particulars address E. Koltko, Waterbury, Conn.

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EXPERIENCED GRINDER WANTED on Micrometer work. Steady position for first class man. State salary and give references. Address: Chiffre, P. O. Box 773, New York City.

PROPOSALS

OFFICE OF STATE HIGHWAY COMMISSIONER
Richmond, Va., March 23, 1915.

The Board of Supervisors of Buckingham County, Virginia, will be glad to receive proposals for the renting of Dinky Engine and cars, also seven (7) miles of rail.

Address all communications to W. J. Hubard, Clerk, Buckingham, Virginia.

G. P. COLEMAN,
State Highway Commissioner

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Wireless Telegraph and Railroading

(*Concluded from page 338.*)

headquarters are instructed to listen for a period of five minutes, and if no one is calling, they call the nearest station for a period of five minutes. The result is that the various stations get into communication with one another in a very few moments.

During the year 1914, two very bad storms were experienced. One in March completely wrecked pole lines in New York, New Jersey, and in Pennsylvania, and the only means of communication for ten days was the wireless.

Again early in December these regions were visited by a severe ice storm, and for a period of three days, the wireless was the only means of communication. In both these instances the results were entirely satisfactory. The total loss of means of communication is a thing of the past. It is a fact that the first wireless train order was transmitted by the Lackawanna Railroad between Scranton and Binghamton on November 18th, 1913.

Besides the communication between a train and a fixed station, constant communication is possible between all the fixed stations. The country between these stations is mountainous, but nevertheless, the service is excellent.

As seen from the data of stations, the installation at Hoboken is the largest. The photographs herewith are of that station and a description of it may interest the readers of this journal.

The large tower to the right of the picture is 402 feet high from the foundation to the ball on top of the pole. The base of this tower is 40 feet square, and the weight of steel used in the construction of this support is 15 tons. The tower was constructed by the railroad company at a cost of $5,000. The other tower, left of the picture, which is part of the passenger station, is 175 feet high. The aerial consists of six phosphor bronze wires stretched between these towers, a distance of 600 feet. The spreaders and insulators can be seen in the photograph.

The station proper is located in the passenger terminal. The transmitting set is situated in back of the two panels, and is as follows:

The transformer, which can be seen under the left panel or switchboard, is 5 kilowatts with an overload capacity of 7½ kilowatts. The primary voltage is 220 and the secondary 12,500, with a frequency of 500 cycles. The condenser unit is made up of 16 large copper coated jars.

The oscillation transformer is of the pancake type, and its coupling is varied by simply turning the lower knob on the panel to the right. Six pancake type helices are used for stepping up the wave to high wave lengths. These loads are varied by the top knob on panel to right.

The meter on this panel (right) is a hot wire ammeter. Directly below it is the wheel for varying the wave length from 1,040 meters to 3,000 meters. The wavelength used at present is 2,600 meters.

The left-hand panel controls the motor generator, and contains all necessary switches and rheostats. The current enters the motor generator at 125 volts direct current and supplies the transformer with 220 volts alternating current.

In conjunction with the transformer a large variable reactance coil is used to vary the secondary voltage. The spark gap used is of the quenched type with a blower forcing a large blast of air on the gaps, for clearing and cooling the same.

In back of and a little to the right (Fig. 2) of the aerial switch, the relay for breaking the primary current can be seen. The relay is operated by an ordinary telegraph key, which may be seen to the right of the operator's hands.

The receiving set is of Marconi design and consists of what is known as their valve tuner. In conjunction with this are many other instruments to form a more selective system of tuning. As seen from the picture the set for reception is a rather complicated affair, and the electrical connections are kept secret by the builders of the apparatus.

The Lackawanna Railroad Company has not made any tests for distance, but

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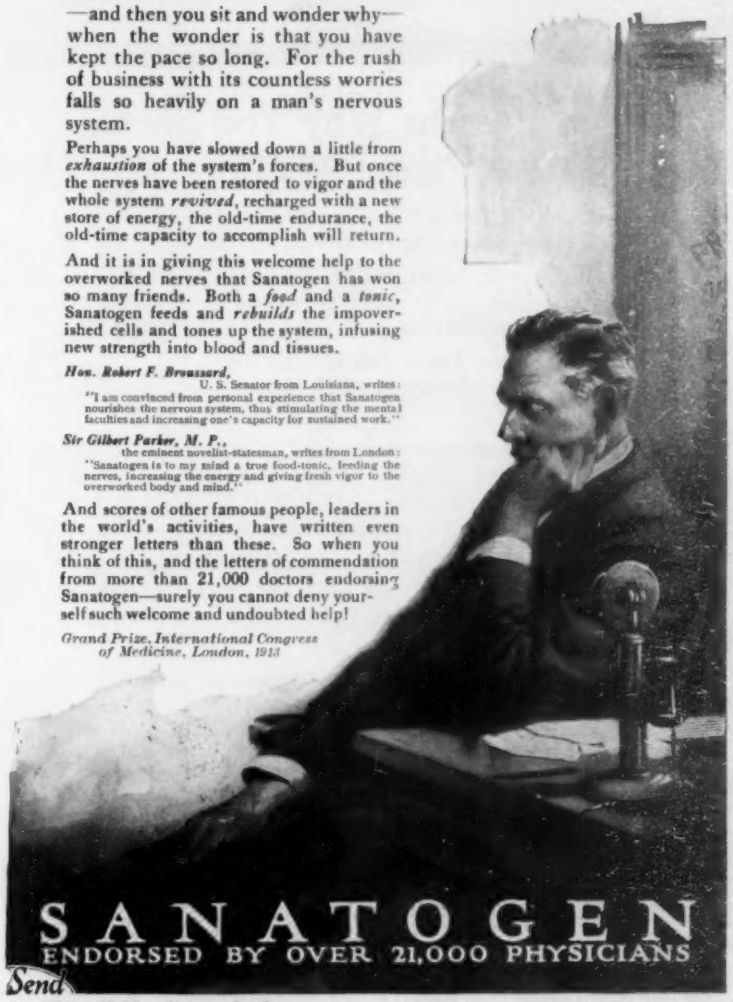

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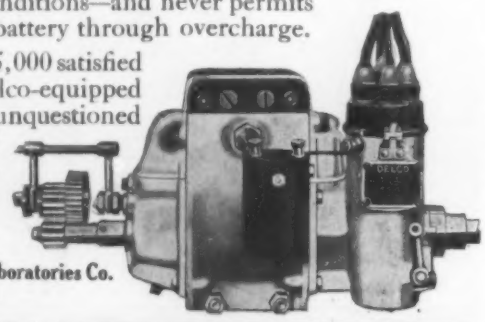

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An Important Development in Color Photography

(*Concluded from page 341.*)

fitted, carrying the two filters and plate holders, so that first one picture can be taken, then the back slid along and the other picture taken at once. This camera enables the two exposures necessary to be given very rapidly one after the other, the total exposure, using the powerful artificial light which has been adopted, being only about three seconds. Great attention to detail is necessary in the process, if the best results are to be obtained.

Portraits produced by this process are in the form of transparencies and are intended to be viewed in a special illuminator which lights them evenly from behind by electric light, this illuminator being attachable to any electric light fitting. Finished portraits illuminated in this manner add to the attractiveness of library or living-room.

The process cannot be used for the production of paper prints, and in most cases it is convenient to transform the original negatives into the finished positive, but, if desired, duplicates can be made by making contact positives from the original negatives, from which new negatives are printed which are then transformed into the color images. This duplication process enables retouching, both of the negative and positive, to be employed if desired.

The new process, according to its inventors, is not well adapted, in its present form, to outdoor subjects, especially where blue sky is included in the picture. The limitation of the process to transparencies must also be remembered. It represents, however, a highly satisfactory and practical method of obtaining beautiful color portraits having first-rate photographic quality and giving a pleasing reproduction of the colors to the original.

Color Music

(*Concluded from page 343.*)

must be disposed of for the protection of the filters. The filters differ for the several hues. In some cases they consist of two thicknesses of colored glass bound together. In others, of one clear glass, a thickness of theatrical colored gelatine and one colored glass, and in still others, the colored gelatine is employed between two clear glasses.

As examples, to effect the hue of green, two thicknesses of imported green glass are used, between which two different kinds of green gelatine are placed; but to effect the hue of red, a single thickness of red glass is employed.

In all cases, the principal desideratum in the construction of the filters is approximately mono-chromatic light, with a minimum of absorption in the filter. The light units are equipped with thin metal closing strips, with a view to the avoidance of leakage of white light through the openings left for the ventilation of the color filters.

The light units, with the filters, were mounted for this concert on a horizontal belt revolving on pulleys in turn mounted upon a rigid steel frame. A small motor mounted upon this frame drove one of the pulleys through a worm gear and revolved the belt. To avoid the numerous moving electrical contacts which would be required by a continuous revolution of the belt, arrangements were made for the automatic reversal of the motor field; in this way, with each half-revolution of the lamps, the motor was reversed, each lamp moving through an arc of 180 degrees and returning over the same path.

To conform to the limitations of the space available on the stage of Carnegie Hall, the belt was arranged in an ellipse thus bringing one row of lamps behind the other and removing it by about thirty inches.

The hues thus provided were thrown

nevertheless, such stations as Nauen, Germany, and stations of similar distances are heard very clearly and at all times of the day.

The operator in charge of the station at Hoboken is Mr. Gillon, a man who has had great experience in radio work.

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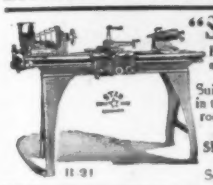

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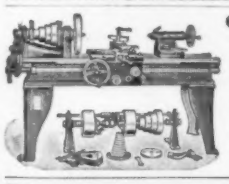

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upon diaphanous materials, which, in sheets of about 8 feet by 10 feet each, were mounted vertically directly over the light sources. The materials in the front of the group were most diaphanous, the others being graduated until the last was reached, which consisted of a rather heavy mesh net, presenting a large surface for reflection purposes. The whole body of gauzes was mounted within a black square inclosure, thus preventing the play of light upon the surrounding surfaces and distracting from the colors as displayed on the gauzes. The effect of this arrangement was that the observer saw the light of one hue displayed upon the rear gauzes and the light of a different hue displayed upon the front gauzes, the one being visible through the other.

The final result of this was a beautiful combination of hues not precisely identical in any two portions of the screen and varying in appearance, as does changeable silk in dress materials, when shown under strong light. This arrangement avoided a difficulty which would otherwise have been experienced had the colors been juxtaposed or superimposed upon one surface. At the same time the slight appearance of animation obtained by moving the light sources slowly around as the belt revolved operated to avoid the monotony which would have been consequent upon the employment of a given hue uniformly in a given portion of the screen. It produced, also, much more interesting blends of color, and any combination of two colors which was displayed for a number of measures of the music changed its precise appearance continually and at no time became monotonous.

The space occupied by the color apparatus, outside of the keyboard, was about 10 feet by 5 feet. The apparatus was 16 feet high, from the floor to the top of the gauze.

It must not be supposed that this is the first attempt to treat color musically. Readers of the SCIENTIFIC AMERICAN will recall that Prof. Rimington of London devised what he calls a color organ which was to do for light what a symphony orchestra does for musical sounds. So far as we are aware, Prof. Rimington's scheme was never carried out in practice on a large scale, so that the performance of Scriabine's "Prometheus" may probably be regarded as the first successful experiment of its kind that has ever been made.

Bricks Without Clay

MAKING bricks without straw is a familiar quotation, but making them without clay, or its equivalent, which from time immemorial has been the essential ingredient, is a novel suggestion. This, however, is what is now proposed, and a plant is being built in Illinois. According to the *Railway Age Gazette*, the process consists in chemically combining any coarse material containing silica with a binder of finely divided particles of silica, alumina, potassium, or sodium in suitable proportions to insure a binder with a low fusing point, as compared with the coarse body material. The bricks are molded under high pressure, preferably in a dry state, and are fired in a manner similar to that used in making ordinary brick, but the time required is not nearly as long. Bricks made by this process have been tested and have shown very satisfactory absorption qualities, and have withstood a temperature of 2,900 deg. Fahr. without cracking or showing damage. They have undergone crushing tests of 20,000 pounds per square inch without failure. The samples examined show a texture capable of taking a high polish, and the grain is so fine that clean-cut carving is possible, but these qualities evidently depend on the character of the material of which bricks are made. It is proposed to use the tailings from coal mines at the new Illinois plant, and it is stated that, on account of the wide variety of materials that can be used in the new process, including many waste products, these bricks can be profitably made in localities where ordinary brick cannot be produced on account of the absence of suitable clay.

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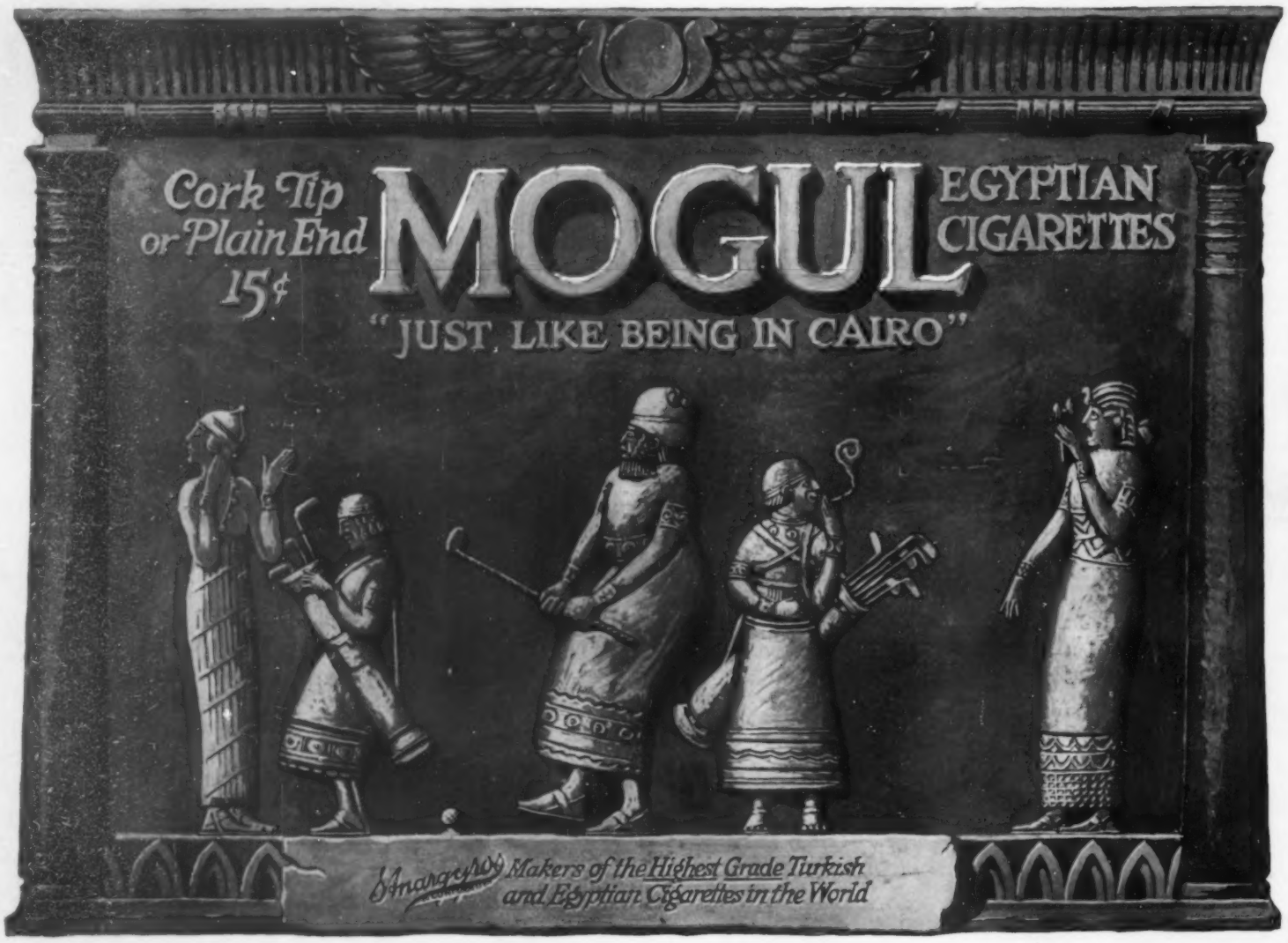

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